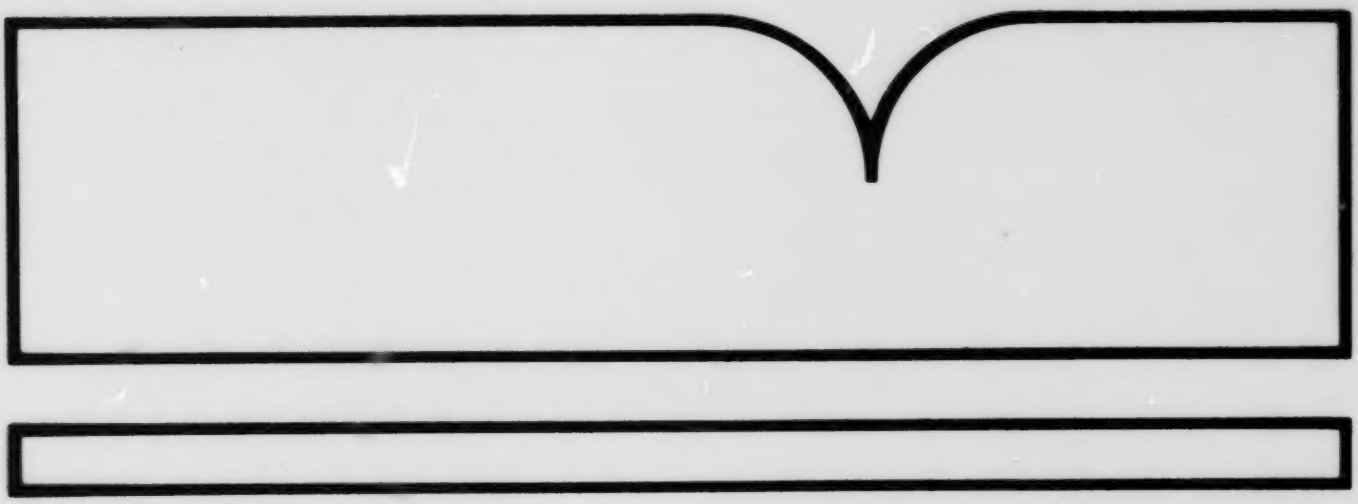
PB88-126529

Superfund Record of Decision (EPA Region 3) Saltville Waste Disposal Site Saltville, Virginia (Remedial Alternative Selection), June 1987

(U.S.) Environmental Protection Agency
Washington, DC

30 Jun 87



U.S. Department of Commerce
National Technical Information Service
NTIS

PB88-126529

United States Environmental Protection Agency

Office of Emergency and Remedial Response

EPA/ROD/R03-87/035
June 1987

EPA

Superfund Record of Decision:

SALTVILLE WASTE DISPOSAL, VA

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA. 22161

Although extensive data has been collected on contaminants at the site, this information is considered inadequate. Some of the problems are: the quality assurance/ quality control data for all analysis is not available; only filets from juvenile fish of two species are being analyzed; there are only five sampling stations in over 80 miles of river; sampling stations were selected arbitrarily; and much of the data is simply outdated. The Fish and Wildlife Service and EPA believe that a complete bioassessment of the biological environments potentially impacted by contaminants at the site is necessary to adequately develop a comprehensive set of remedial actions to mitigate or eliminate the impacts of contaminants at the Saltville Site.

The concentrations of methylmercury in fish are believed to be highly dependent on concentrations of mercury in river sediment. High concentrations of mercury sediment occur in the 83 mile reach extending from the old chlor-alkali plant to the confluence with the South Ford of the Holston. Highest concentrations occur near the Saltvill Waste Pond 5 outfall (River Mile 82). Any permanent action to solve problems from this site will have to address the sediment as well as stopping the discharge of mercury from the site into the river. A bioassessment of the NFHR will be initiated this summer.

Alternatives Evalutation

This section will briefly define the scoping of response actions for the site, screening methods to determine appropriate remedial technologies, and specific alternatives considered. The FS contains a more indepth analysis of these discussions.

A. Scoping of Response Actions for the Site. Pursuant to 40 CFR 300.689(e) of the NCP, an initial analysis must be made during the RI/FS, prior to development of alternatives, which will provide a preliminary determination of the extent to which Federal environmental and public health requirements are applicable or relevant and appropriate to the specific site. A preliminary determination must also be made of the extent to which other Federal criteria, advisories, and guidance and state standards are to be used in developing the remedy. The following discussions provide such an initial anaylsis.

In performing this institutional analysis several Federal and State statutes and associated Federal and State regulatory programs were determined to be neither applicable nor relevant and appropriate to the Saltville Site. As such, these statutes and/or regulatory programs were eliminated from further consideration in this report. A list of these general statutes appears in Table 1. Table 2 and the following text lists and discusses those ARARs associates with the Saltville Site.

RCRA Subtitle C

RCRA Subtitle C and associated regulation (40 CFR 260 through 264) are considered applicable or relevant and appropriate to the Saltville site. Mercury contaminated wastes at the Saltville site are listed as U151 RCRA wastes. Specific RCRA regulations applicable to the site include:

- 40 CFR 264 Subpart G - Closure and Post-Closure, specifically 264.111, .114, .117, .119, .120.

TECHNICAL REPORT DATA *(Please read Instructions on the reverse before completing)*		
1. REPORT NO. EPA/ROD/R03-87/035	2.	3. RECIPIENT'S ACCESSION NO. PB88126529/AS
4. TITLE AND SUBTITLE SUPERFUND RECORD OF DECISION Saltville Waste Disposal Ponds, VA (IRM)		5. REPORT DATE June 30, 1987 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report 14. SPONSORING AGENCY CODE 800/00

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Saltville Waste Disposal site is located along the North Fork of the Holston River (NFHR) between Saltville and Allison Gap in Western Smyth County, Virginia, and partly extends into Washington County, Virginia. The Jefferson National Forest is located approximately one-half mile north of the site.

From 1895 to 1972, Olin Corporation and its predecessors (Mathieson Chemical Corporation and Mathieson Alkali Works) used the site for various chemical manufacturing operations. The site includes a former plant area and two waste ponds, 5 and 6. Between 1951 and 1972, the Olin Corporation operated an electrolytic chlorine and caustic soda plant which released mercury into the process wastes and onto the plant grounds. Mercury losses were estimated by Olin Corporation to be 100 lbs/day from the chlor-alkali processes. In 1963, Waste Pond 6 was constructed to receive waste overflow from Waste Pond 5. According to Olin corporation, no wastes containing mercury were dumped into Waste Pond 6, but structural components of the old plant reportedly were buried at the eastern edge of the pond. Since 1970, annual fish and sediment sampling at NFHR has shown mercury concentrations in the sediments near the site and in fish tissue at concentrations exceeding allowable limits. In 1983, the former plant area was capped with clay and topsoil and seeded with grass, and a rip-rap of boulders and broken stones was installed along the river edge. Mercury, the primary contaminant of concern,
(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Saltville Waste Disposal Ponds, VA (IRM) Contaminated Media: air, soil, sediment, surface water Key contaminants: mercury		
18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)* None	21. NO. OF PAGES 92
	20. SECURITY CLASS *(This page)* None	22. PRICE PC 14.95 / MF 6.95

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16. ABSTRACT (continued)

has been detected at significant levels in soils, surface water, sediments, air and river biota.

The selected interim remedial measure includes: upgrading runon controls with ditches, berms, and/or downchutes; treating Waste Pond 5 outfall using either sulfide precipitation techniques or carbon adsorption; installing ground water monitoring systems; performing additional studies; O&M treatment facility and continued up- and down-gradient NFHR sampling and analyses. The estimated capital cost is either $840,052 or $2,143,052 with annual O&M of either 221,941 or 258,941 pending selection of carbon adsorption or sulfide precipitation treatment respectively. Capital and O&M costs for the ground water monitoring system have not yet been developed.

Record of Decision
Remedial Alternative Selection

Site: Saltville Waste Disposal Site
Saltville, Virginia

Documents Reviewed

I am basing my decision concerning the appropriate interim remedial alternative for the Saltville Waste Disposal Site primarily on the following documents. A substantial number of additional documents are included in the administrative record as well.

1. Saltville Waste Disposal Site Risk Assessment (GCA, July, 1986 and September, 1986).

2. Saltville Waste Disposal Site Feasibility Study (GCA, August, 1986).

3. Summary of Remedial Alternative Selection.

4. Responsiveness Summary.

5. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986.

6. The National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300, November 20, 1985.

Description of Preferred Interim Remedial Alternative

- Upgrade runon controls with ditches/berms/downchutes

- Treat Waste Pond 5 outfall using either sulfide precipitation techniques or carbon adsorption

- Additional Studies

- Installation of groundwater monitoring system at conclusion of studies

- Operation and Maintenance of treatment facility and continued sampling and analysis upgradient and downgradient of the NFHR.

Declaration

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA or the 1986 Act), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, I have determined that at the Saltville Waste Disposal Site, the selected interim remedial alternative is cost-effective and provides adequate protection of public health and welfare and the environment.

The State of Virginia has been consulted and concurs with the selected interim remedial alternative.

The action will require operation and maintenance activities to ensure continued effectiveness of the interim remedial alternative as well as to insure that the performance objectives meet applicable state surface and groundwater quality criteria.

6/30/87
Date

Regional Administrator

COMMONWEALTH of VIRGINIA

DEPARTMENT OF WASTE MANAGEMENT
James Monroe Building, Eleventh Floor
101 North 14th Street
Richmond, Virginia 23219

May 19, 1987

Mr. Thomas Voltaggio, Chief
Superfund Branch
United States Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

Dear Mr. Voltaggio:

The Department of Waste Management (DWM) has reviewed the draft Record of Decision for the Olin Corporation site in Saltville, Virginia. As you are aware, the Virginia Water Control Board (VWCB), other state agencies, and the United States Environmental Protection Agency worked together several years ago to develop a remediation plan for this site. In accordance with that plan, Olin Corporation took remedial measures and has conducted substantial fish sampling. Fish sampling conducted by Olin according to an approved VWCB methodology leads to a conclusion that the remediation of the site was successful in reducing levels of mercury entering the Holston River and entering the food chain.

Nevertheless, the Department of Waste Management recognizes that the Superfund Amendments and Reauthorization Act of 1986 compels a more extensive remediation such as that contemplated by the draft Record of Decision. For this reason, DWM concurs with the remediation proposed in the draft Record of Decision. The Department looks forward to working with you and your staff in this endeavor.

Very truly yours,

Cynthia V. Bailey

cc: Richard N. Burton
K.C. Das, Ph.D.
Pauline M. Ewald

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

Site Description and Summary of Remedial Alternative Selection for the Saltville Waste Disposal Site

Introduction

The Record of Decision (ROD) summarizes the Public Health and Environmental Risk Assessment (RA) and Feasibility Study (FS) for the Saltville Site. These reports were based on existing data and available information supplied by the Saltville Task Force and Olin Corporation (responsible party for the Saltville Site). EPA did not perform a Remedial Investigation (RI) at this site, because of the available data and continuing sampling effort being conducted under a Consent Order (discussed under No Action Alternative) between Olin and the Virginia State Water Control Board (Va. SWCB). A decision was made to conduct a RA based on all available data to determine if data gaps existed. Several data gaps were identified in the RA. The FS developed alternatives based on the available data, however, more data is needed to develop a final cleanup. An interim alternative with additonal studies was selected to remediate the immediate threat.

Site Location and Description

The Saltville Waste Disposal Site is located, as shown in Figure 1 along the North Fork of the Holston River (NFHR), between the town of Saltville and the community of Allison Gap in western Smyth County, Virginia, and extends partly into Washington County, Virginia.

During the period from 1951 to 1972, Olin Corporation operated an electrolytic chlorine and caustic soda plant at the Saltville Site. One of the electrodes used in the chlorine-caustic process contained mercury which was released into the process wastes and onto the plant grounds. Waste Pond 5 was used to dispose of waste sludges from the chlor-alkali processes. In 1963, Waste Pond 6 was constructed to receive overflow from Waste Pond 5. No wastes containing mercury were dumped into Waste Pond 6 according to Olin, but structural components of the old chlor-alkali plant reportedly were buried at the eastern edge of the pond. The site, as shown in Figure 2, includes, the former chlor-alkali plant area and the two waste ponds. The NFHR lies in the area adjacent to the southern border of the site and flows southwest to Tennessee. Figure 3 is a schematic of the Holston-Cherokee system. Sampling and analysis conducted by the Task Force has demonstrated that hazardous substances from the site have migrated to the NFHR, beginning from the area adjacent to the Saltville Site, and continuing down-stream to Weber City, Virginia.

The former chlor-alkali plant area is currently capped with two feet of clay followed by six inches of topsoil, and seeded with grass. Rip-rap consisting of small boulders and broken stones has been installed along the river edge. The site is heavily vegetated, with lush grassy vegetation. The site is fenced on three sides, but is somewhat accessible by crossing the river or by walking across the railroad bridge southwest of the site.

The Jefferson National Forest is located approximately 1/2 mile north of the site. Topography of the area is rugged, lying within the Appalachian Mountains. A small residential area of about 50 homes is located between the former chlor-alkali plant and Waste Pond 5. Immediately east of the former chlor-alkali plant site is a factory (Hub and Wheels Company) which employs approximately 30 to 40 people.

Site History

During the period from 1895 to 1972, the Saltville Site was used by Olin Coporation and its predecessors (Mathieson Chemical Corporation and Mathieson Alkali Works) as the location for various chemical manufacturing operations. Mathieson Chemical Company built the mercury cell chlor-alkali plant in 1950. The plant produced chlorine gas and sodium hydroxide by passing brine, obtained from salt deposits in the area, between electrodes. The cathode used in this process contained mercury and was the source of mercury wastes. The current passing through the brine caused the formation of chlorine gas at the anode through electrolytic oxidation. At the same time, a sodium amalgam was formed at the cathode. This amalgam was passed into a decomposing tower where the sodium was separated by flushing it with water to form sodium hydroxide. Much of the mercury lost in this process was solubulized and passed into Pond 5 in the sludges and brine. Additional mercury was lost through sloppy operating procedures. Mercury losses were estimated by Olin at 100 lbs/day from 1951 - 1970.

In 1954, Olin Corporation merged with Mathieson Chemical Corporation. In 1964, the Minimata Bay poisoning in Japan incident drew attention to the toxic effects of mercury in the environment. An investigation of the plant site and nearby river revealed severe mercury contamination at the site and in the river. As a result of fish and sediment sampling, both Virginia and Tennessee placed a ban on fishing in the North Fork of the Holston River. Later, both bans were reduced to cover consumption of fish only.

After discovery of the problem, Olin modified its operating procedures to cut mercury losses to 1/4 lb. per day. In 1970 the Va. SWCB adopted a Total Dissolved Solids Standard of 500 mg/l for the river, which Olin was unable to meet. As a result of this, as well as increased operating costs, Olin decided to close its Saltville operations. The final shut down occurred in 1972. The chlor-alkali plant was demolished in 1973.

Since 1970, fish and sediment sampling in the North Fork of the Holston River has been performed every year, showing mercury concentrations in the sediments near the site and at concentrations exceeding allowable limits in fish tissues. In 1978, a task force was formed by concerned agencies including the Va. SWCB, Va. Attorney General's Office, Tenn. and Va. State Departments of Health, the Tennessee Valley Authority, and the USEPA. The task force has been involved in negotiations with Olin Corporation concerning possible cleanup measures to solve or at least lessen the mercury contamination problem in the NFHR. In December 1982, the site was listed on the Proposed National Priorities List of 418 sites. In 1983 Olin diverted a 1300 foot section of the river and dredged 1000 feet of the exposed river bed. Mercury was then extracted from the dredged sediments. The sediments were spread over the plant site, and encapsulated; then the site was capped. In addition, Olin has placed rip-rap along the riverbanks to stop erosion and has installed a western upland diversion ditch around Pond 5 to lessen surface water runoff flow into the pond. The diversion ditch failed twice due to heavy rain, the most recent being in April 1987.

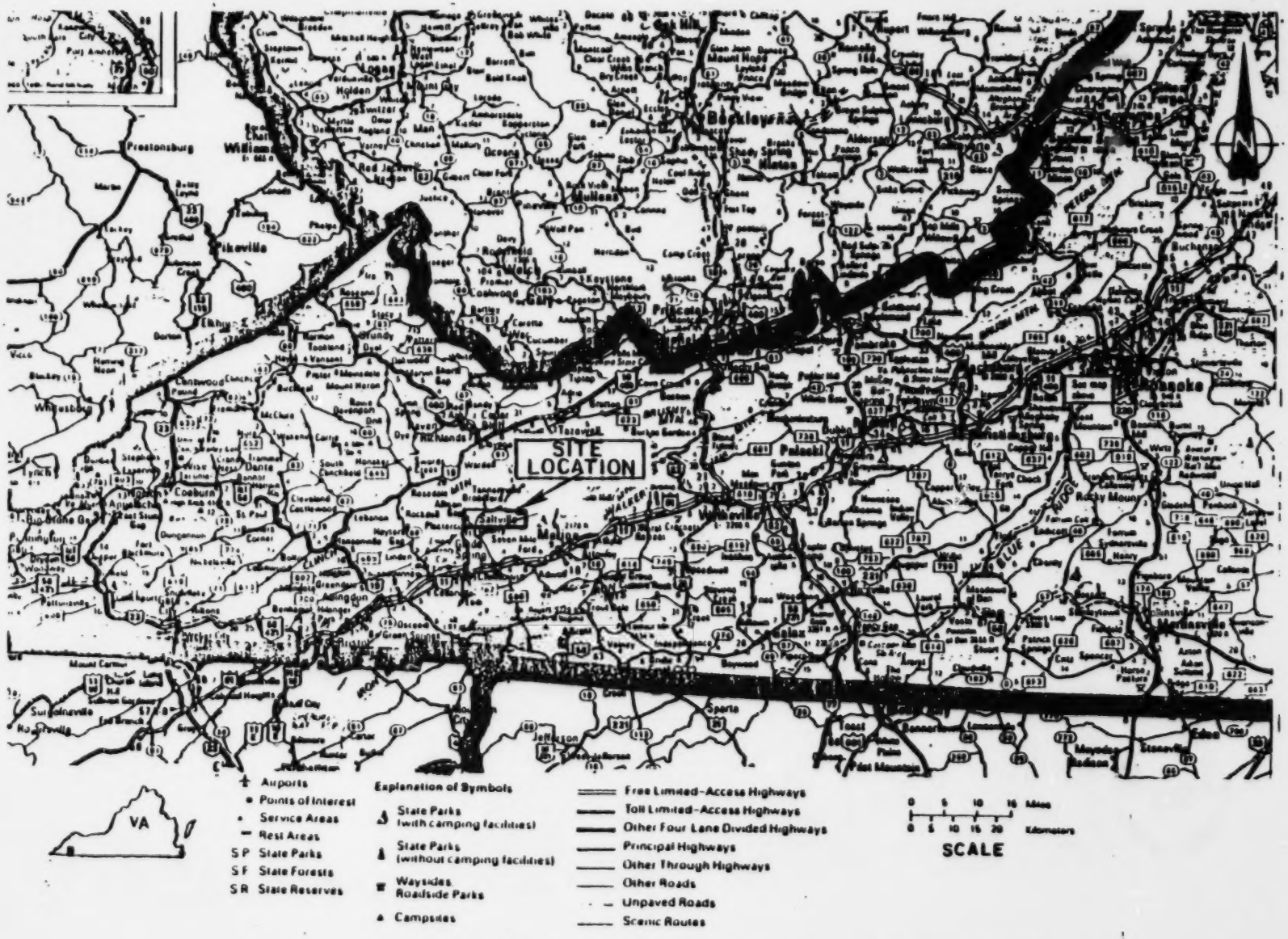
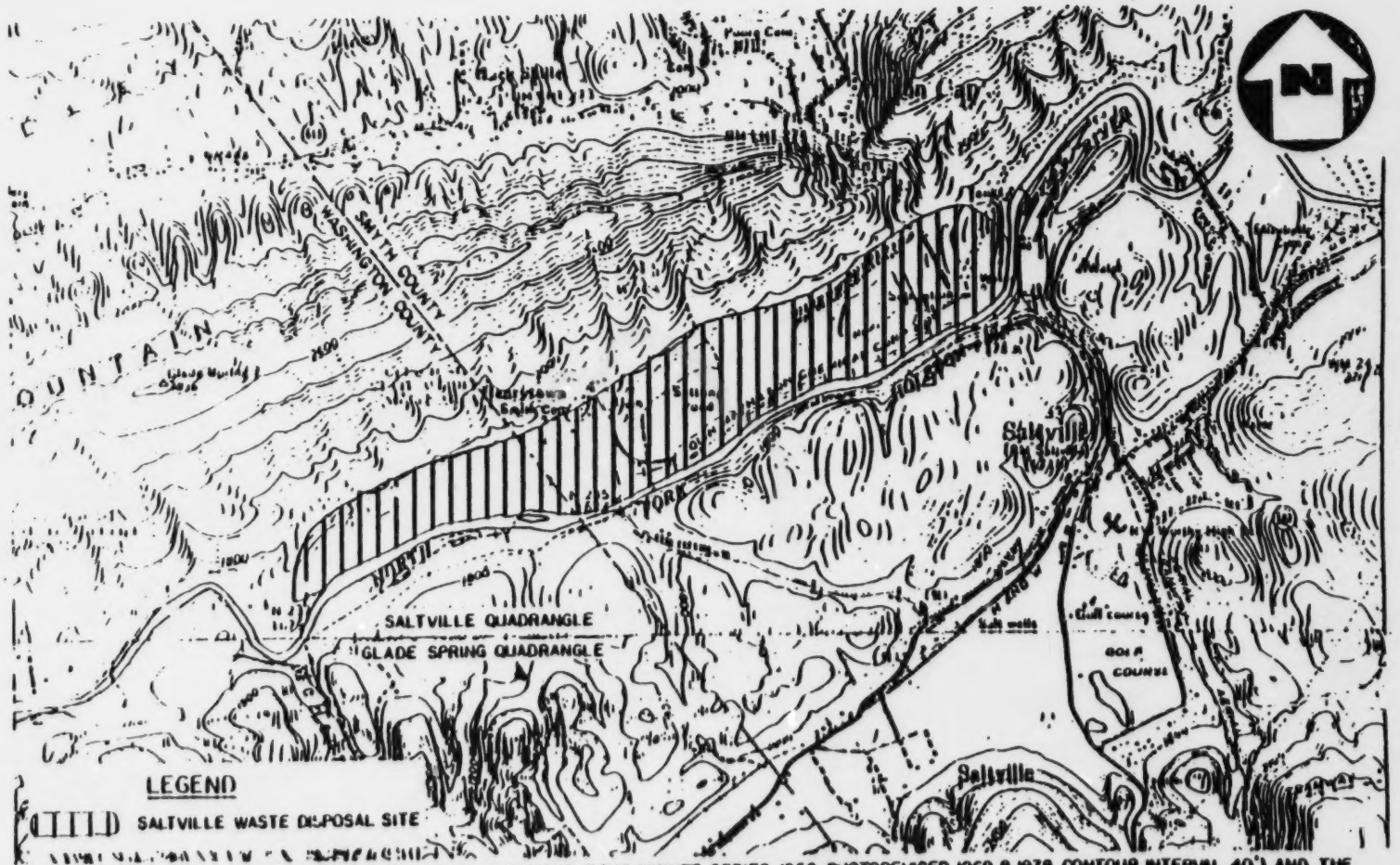


Figure 1 Map of Virginia showing the location of Saltville, VA.



BASE MAP IS A PORTION OF THE USGS SALTVILLE, VA QUADRANGLE (7.5 MINUTE SERIES, 1958, PHOTOREVISED 1969 & 1978, CONTOUR INTERVAL 40') AND THE GLADE SPRING, VA QUADRANGLE (7.5 MINUTE SERIES, 1938, PHOTOREVISED 1969, CONTOUR INTERVAL 20').

Figure 2 Topographic map showing the area designated as the Saltville site. Source: Orient, 1984.

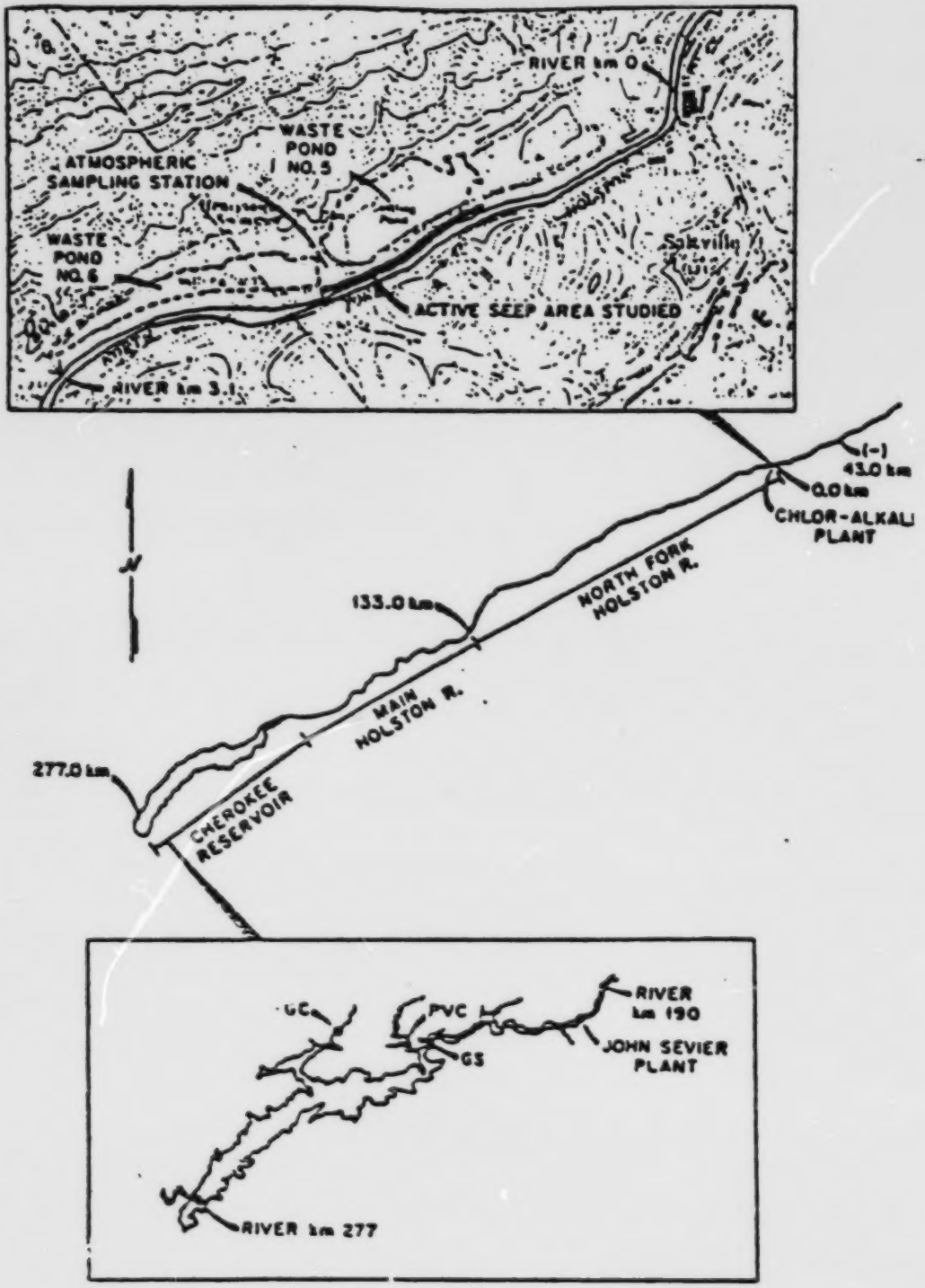


Figure 3 Schematic of Holston-Cherokee system.

Current Site Status

The contaminant of concern at the site is mercury. Sampling of air, soils, surface water, sediments and biota from the NFHR has been performed during the past 15 years by Olin and the Task Force, with mercury being detected in all media. Air monitoring has detected insignificant levels of particulate mercury; however, elevated mercury vapor concentrations were detected in June 1983, while remedial activities were being conducted at the site. Surface water sampling by Oak Ridge National Laboratory (ORNL) in 1975 detected insignificant levels(<0.2 mg/l) of dissolved mercury in filtered water, but significant (>1ppm) levels of mercury on suspended particulates in the river. Mercury in the Waste Pond 5 effluent ranged from 10 to 120 ug/L. Low levels of cadmium, lead and arsenic (<1 ug/4 were also found in Waste Pond 5 effluent. The result of waste sampling and analysis led to the conclusion that about 53,000 lbs of mercury are contained in Waste Pond 5 with 92 percent (49,000 lb) contained in the upper 17 1/2 ft. The mercury is concentrated in the west end, the northeast corner, and the far east corner of the pond. Mercury in the upper 17 1/2 feet of these areas (29 acres total) represents about 69 percent of the total mercury in the pond. Sediment sampling in the NFHR showed that levels (above 1 ppm) are present at most sampling stations up to 80 river miles downstream from the Saltville Site. The majority of fish samples collected below the Saltville Site contained edible-portion mercury concentrations greater than 1.0 ppm (FDA standard).

The known principal source of continuing mercury flux into the NFHR is via seepage from the Waste Pond 5 outfall. Mercury flux into the NFHR from ground water from waste ponds cannot be quantified due to the absence of analytical data. It appears from reviewing all existing data that not all of the potentially contaminated areas have been sampled. The extent of the area acting as a possible source of contamination is unknown and the quantity of mercury which can be leached to the groundwater is unknown. If there is a vertical component of flow downward in the aquifer or if the horizontal flow component has not been fully determined and some groundwater flows away from the river, then mercury leaching into the groundwater may be impacting the aquifer and not just the river. The geohydrology has not been fully characterized at the site, thus a groundwater study for the area is needed before a final remedy can be selected.

The major mechanism for removal of dissolved mercury from the water column is absorption onto the surfaces of particulate phases and subsequent settling to the river bed sediment. Additionally, some dissolved mercury is ingested by aquatic biota or transported by river currents. Secondary transformations of mercury in the sediments occur, these include precipitation as HgS and methlylation by bacteria. Since the mercury itself is not destroyed, these inorganic and organic forms of mercury may then release ionic or metallic mercury into the water column as part of a recycling process.

Resuspension of sediments by turbulance or activity of benthic organisms can also release these compounds of mercury directly into the water column. The primary sink for mercury released to the environment is thus the sediments.

The alkylation of mercury to methyl- and dimethyl-mercury is of particular importance with respect to the environmental fate of mercury for the following reasons:

- Methylated mercury compounds are highly water soluble;
- They are rapidly and easily absorbed through biological membranes;
- They are not readily degraded or released from the animal body; and
- Mercury is preferentially soluble in the lipid-rich membranes of living cells and, therefore, can be taken up from water by living organisms.

Consequently, mercury accumulates in fish and other organisms, almost entirely in the form of methylmercury and is biologically magnified up the food chain to higher fish and birds. These compounds are taken up by fish directly through the gills, as well as through the food chain. It has been reported that fish can concentrate methylmercury by an overall factor of 3,000, while shellfish concentrate it by a factor of 100 to 100,000. This is particularly significant since alkylmercury compounds are 10 to 100 times more toxic than the inorganic forms.

The rivers of southwest Virginia support perhaps the richest density and diversity of freshwater mollusks in the world. These river systems presently support populations of ten species of freshwater mussels on the Federal Endangered Species List. Recent field surveys indicate that the NFHR above Saltville, Virginia supports a relatively diverse mussel fauna of 15 species, one of which is an endangered species. Field surveys conducted below Saltville show the river to be devoid of mollusks for a distance of 80 miles downstream to its confluence with the South Fork of the Holston River. Historically, the North Fork below Saltville supported 34 mussel species, four of which are now on the Federal Endangered Species List (Va. Fish and Wildlife Service, January 6, 1987).

Concentrations of mercury present in various fish species analyzed below Saltville for 75 miles show that mercury concentrations in fish filets exceed 1 ppm for 85% of the fish. These mercury concentrations may pose a chronic risk to various carnivorous mammals and fish eating birds such as eagles and herons. As part of the 1983 Consent Order, Olin is monitoring mercury concentrations in filets of juvenile northern hogsuckers and bluegill to determine human exposure and environmental risks. Tissue concentrations of mercury in filets do not reflect the total body burden of mercury and fish health. Many fish species contain the highest mercury concentrations in liver and kidney. Analysis of fish on a whole-body basis or analysis of specific organs is necessary to determine the total mercury present in the food chain and potentially available to predators (Fish and Wildlife Service, January 6, 1987).

TABLE 1. STATUTES NOT APPLICABLE OR RELEVANT AND APPROPRIATE TO THE SALTVILLE WASTE DISPOSAL SITE

Statutes Not Applicable or Relevant and Appropriate	Justification for Elimination
Open Dump Criteria, RCRA Subtitle D.	None of the proposed remedial alternatives call for open dumping. The waste onsite is considered a RCRA Subtitle C hazardous waste.
Coastal Zone Management Act.	The Saltville site is not within or adjacent to the Virginia coastal zone, nor are the proposed remedial actions expected to influence the coastal zone.
Wild and Scenic Rivers Act.	The Virginia Division of Parks and Recreation has verified that the North Fork of the Holston River is not currently a Federal or State designated or proposed wild or scenic river (GCA Telecon with Dick Gibbins, June 1986).
National Historic Preservation Act of 1966; Executive Order 11593.	There are no known historic properties which could be adversely affected by the proposed remedial alternatives. The Saltville site is not listed on the National Register.
Atomic Energy Act, Low-level Radioactive Waste Policy Act.	There are no known radioactive wastes contained at the Saltville site.
Safe Drinking Water Act; Underground Injection Control Permit; Sole Source Aquifer Permit.	The Saltville site is not located on or near a sole source aquifer or a drinking water source. Proposed remedial alternatives do not include injection of wastes or treated water into the ground.
Toxic Substance Control Act; Federal Insecticide, Fungicide or Rhodenticide Act.	There are no known PCB-contaminated wastes or pesticide-contaminated wastes contained at the Saltville site.

TABLE 2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) ASSOCIATED WITH THE SALTVILLE WASTE DISPOSAL SITE

Applicable or Relevant and Appropriate Requirements (ARARS)	Summary
RCRA Subtitle C	Mercury contaminated wastes located onsite (Waste Pond 5 and associated effluent) are considered RCRA listed hazardous wastes, EPA ID No. U151. Therefore, RCRA Subtitle C and associated regulations are applicable or relevant and appropriate to the Saltville site.
RCRA Regulations:	
o 40 CFR 264 Subpart G	Requires proper closure and post-closure at RCRA sites.
o 40 CFR 264 Subpart F	Requires monitoring of ground water at RCRA sites and implementation of corrective action measures when ground water contamination is evident. Subpart G triggers these requirements upon closure. Subpart F specifies a maximum contaminant level for total mercury at .002 mg/l to protect ground water (264.94).
o 40 CFR 264 Subparts, K and N	Contain specific requirements for run-on and run-off controls and capping of surface impoundments and landfills. If waste is left in place in Waste Pond 5 upon closure, landfill requirements (Subpart N) become applicable. If wastes are removed upon closure, surface impoundment requirements (Subpart K) become applicable.
o 40 CFR 263	Contains specific requirements for transporting wastes offsite.

TABLE 2

Applicable or Relevant and Appropriate Requirements (ARARS)	Summary
Virginia Hazardous Waste Management Regulations	Virginia has received RCRA Final authorization. Virginia regulations are similar to federal RCRA regulations with some exceptions. The maximum contaminant level to protect ground water is .002 mg/l for total mercury Section 10.06.05).
Clean Water Act	The federal CWA and associated regulations are applicable to the Saltville site because the site is directly impacting the quality of the NFHR (a navigable water way) and its fish and biota.
° CWA Section 304	EPA has published federal ambient water quality criteria for the protection of freshwater aquatic life. Federal criteria for total recoverable mercury in freshwater is 0.012 ppb. Federal criteria are not legally enforceable.
° CWA Sections 401 and 404	Under Section 404, the Army Corps of Engineers has permit jurisdiction over projects located in or directly impacting waters of the U.S. by way of the discharge of fill material. EPA has the responsibility of evaluating proposed actions, to ensure a minimization of aquatic impacts, in accordance with the Section 404 (b)(1) guidelines, 40 CFR Part 230. Any proposed remedial alternative involving the discharge of fill material located in or directly impacting a water of the U.S. must be regulated by the Corps. Under Section 401, the governing agency (Federal or State) must certify that the project (alternative) meets all applicable regulations and guidance. The NFHR is the only water of the U.S. in the vicinity of the Saltville site.
° Section 10 of the River and Harbor Act of 1899.	The River and Harbor Act requires authorization from the Corps of Engineers for any excavation in the navigable waters that would be responsible for altering its conditions or capacity.

5d

TABLE 2

Applicable or Relevant and Appropriate Requirements (ARARS)	Summary
° CWA Section 402, 40 CFR 122	Effluent flowing from Waste Pond 5 to the NFHR is currently not permitted, however, it may be subject to a NPDES permit in the future. Alternatives proposing to treat the effluent prior to entering the NFHR wil be dictated by the NPDES permit process
Virginia State Water Control Law	The State Law and associated regulation are applicable to the Saltville site because the site is impacting the NFHR and its fish and biota. Virginia has authority to administer its own NPDES program and has promulgated state water quality standards.
Virginia Water Regulations:	
° Virginia Water Quality Control Standards (Effective 5/28/86)	Total recoverable mercury standard in fresh water is 0.05 ppb methyl mercury Although it is stated within the standa that they are not applicable to the NFH until January 28, 1987, the Task Force has informed Olin that Olin should consider these standards applicable to then The methyl mercury standard is not currently being used at the Olin site du to the lack of methyl mercury data. Therefore, the total recoverable mercury water quality standard of 0.05ppb is the only legally enforceable ARAR for NFHR.
° Virginia Water Quality Control Policy (Effective 5/28/86)	Total recoverable mercury in edible fish tissue shall not exceed 750 ppb; total mercury in fresh water river sediments shall not exceed 300 ppb. These policy levels act as action

TABLE 2

Applicable or Relevant and Appropriate Requirements (ARARS)	Summary
	levels which trigger some type of agency attention/action when exceeded. These action levels have been exceeded and a fishing ban on the NFHR currently exists in the vicinity of the Olin facility and downstream.
Floodplains and Wetlands Guidance, Executive Orders 11988 and 11990	These guidance and Orders state the procedures of floodplain management and wetland protection. Executive Order 11990 restricts federal agencies from undertaking or providing assistance for construction in wetlands. Executive Order 11988 requires that Federal activities in floodplains must reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare and preserve the natural and beneficial values served by floodplains. A FEMA flood prone map indicates that only a portion of the river bank is in the 100-year floodplain. If a proposed remedial alternative is to be located within the 100-year floodplain, it must be consistent with state and local floodplain and zoning requirements.
Fish and Wildlife Coordination Act	Federal agencies issuing a permit to modify any body of water must consult with Federal and State wildlife agencies to ensure that resources are appropriately protected. Any proposed

TABLE 2

Applicable or Relevant and Appropriate Requirements (ARARs)	Summary
	remedial alternative that may affect the NPHR must be reviewed by the U.S. Fish and Wildlife agency as well as the Virginia Fish and Game Commission and the State Water Control Board.
OSHA, 29 CFR Parts 1910 and 1926	Any proposed remedial alternative which requires workers to enter CERCLA sites must provide for adequate protection of human health. Regulations and guidance promulgated under the Occupational Safety and Health Act must be considered prior to implementation of any alternative.
Archeological and Historic Preservation Act of 1974	The Archeological Research Center in Richmond, Virginia has determined that the Saltville site has potential to contain significant archeological deposits. Prior to choosing a remedial alternative, the Center must make a final determination on archeological significance in the area and be included in reviewing the proposed alternatives.
National Environmental Policy Act (NEPA)	Federal agencies are required to consider all environmental impacts of proposed alternatives. NEPA requires the preparation of an Environmental Impact Statement (EIS) and compliance to associated procedures. If the proposed alternative complies with NCP requirements at 40 CFR 300.68 and there is sufficient opportunity for public comment, an EIS is not required.
Government and Public Involvement	CERCLA requires public involvement during the FS process. Guidance is included in the EPA publication entitled "Community Relations in Superfund: A Handbook".

RCRA Subtitle C

- 40 CFR 264 Subpart N - Landfills, specifically 264.310 and .301 (c), (d), (e). This Subpart becomes applicable if the mercury contaminated wastes remain in place in Muck Pond 5 at closure. RCRA contains provision for capping and runon and runoff controls. EPA has published guidance on RCRA landfill caps.

- 40 CFR 264 Subpart K - Surface Impoundments. This subpart becomes applicable if the mercury contaminated wastes in Pond 5 are removed prior to or during closure.

- 40 CFR 264 Subpart F - Groundwater Protection. This Subpart is triggered by Subpart G upon closure of the site. The EPA Regional Administrator will need to specify hazardous constituents to monitor for, the point of compliance, and the groundwater concentration limit (MCL) of 0.002 mg/l mercury for groundwater protection. Under 264.100 corrective action is required if groundwater concentration is discovered during monitorings specified under Subpart F, which exceeds the required standrd.

The Hazardous and Solid Waste Amendments of November 1984 (HSWA), amending RCRA, may also trigger corrective action to be implemented offsite for releases that have migrated offsite.

The State of Virginia has authority to run the RCRA program in Virginia. The Virginia hazardous waste management program is implemented and enforced by the Virginia State Department of Health (DOH), Division of Solid and Hazardous Waste Management. The applicable statutes and regulations are Chapter 6, Title 32.1, Article 3, Code of Virginia (1950), Solid Waste Management and the Virginia Hazardous Waste Management Regulations. The Virginia statutes and regulations are substantially equivalent to their Federal counterparts with some more stringent provisions. Under groundwater protection, the Virginia regulations specify a maximum contaminant level (MCL) of 0.0002 mg/l of mercury (Section 10.06.05).

In addition, RCRA regulations contain provisions applicable to hazardous waste transportation, treatment, and disposal (40 CFR Parts 262 - 264). For example, remedial alternatives proposing to transport waste offsite will need to be performed in compliance to 40 CFR 263. In addition, alternatives to treat and/or remove wastes will need to be in compliance with applicable subparts under 40 CFR 264.

Clean Water Act

The Federal Clean Water Act (CWA), as amended, and similar State Water Control Laws and regulations are also applicable to the Saltville Site. Section 304(a)(1) of the CWA sets forth ambient water quality criteria for the protection of freshwater aquatic life and human health. The Federal criteria for total recoverable mercury in fresh water is 0.012 ppb.

The Virginia SWCB has the authority under the CWA to promulgate water quality laws and standards. The Virginia State Water Control Laws and standards are legally enforceable. Virginia promulgated the following state standards: 0.05 ppb of total mercury in freshwater and 0.02 ppb of methyl mercury in freshwater, effective May 28,1986. Virginia has also published a policy document for mercury in fresh water which states that, effective May 28, 1986, the level of methyl mercury in edible fish tissue shall not exceed 750 ppb and the level of total mercury in freshwater river sediments shall not exceed 300 ppb.

Exceedence of these levels will trigger an investigation, possible abatement actions and other actions such as imposition of a fishing ban.

Protection of freshwater aquatic life is of importance to Saltville because of the presence of freshwater fish and associated biota in the NFHR./ The river, classified as a mountainous stream (Class IV), has been a frequented recreational fishing area for many years. A State fishing ban has been in place of the vicinity of the Olin plant and downstream to the Tennessee border since the early 1970s. The fishing ban, put in place by the Virginia DOH, was the result of discovering that fish in the area of the Olin plant possessed mercury concentration levels in the fish tissue exceeding FDA's action level of 1 ppm total mercury. The fishing ban has remained in place and is not expected to be lifted in the near future. Additional State standards, under the Virginia Water Quality Control regulations, that apply to Class IV waters include: minimum of 4.0 and daily average of 5.0 mg/l of dissolved oxygen, maximum temperature of 31°C, and a pH range between 6 and 9.

Section 402 of the CWA covers the implementation of the National Pollutant Discharge Elimination System (NPDES) permit program. Virginia is authorized by EPA to administer the State NPDES program. Applicable regulations are the Virginia Discharge Permit Regulations also promulgated under the Virginia Water Control Laws. The Virginia NPDES program covers the discharge of sewage, industrial wastes, and other pollutants to waters of the State of Virginia.

Section 404 of the CWA covers filling activities in waters of the U.S. including wetlands areas. The Army Corps of Engineers has the authority to regulate construction activities in waters of the U.S. Any activities proposed in such waters will need to be permitted by the Corps, and reviewed by EPA and the U.S. Fish and Wildlife Service. Activities proposed in the river such as dredging will require authorization pursuant to Section 10 of the Rivers and Harbors Act of 1899, as well as the Virginia Marine Resources Commission who has jurisdiction over the subaqueous beds and lands, and the Va. SWCB who has jurisdiction over freshwater water quality. The Virginia Commission of Inland Fisheries and Game, and most likely the Va. DOH, will also require a review of the proposed activities.

There is only a small portion of the banks of the NFHR are in a 100-year floodplain. Waste ponds 5 and 6 and surrounding borders are not located in a 100year floodplain. Proposed alternatives involving construction of a treatment facility on the bank of the River will not likely trigger the floodplain regulations and guidance.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires that Federal agencies consider all environmental impacts of proposed actions. NEPA, therefore, contains applicable statutory requirements for Saltville. Procedures for implementing the Act are specified at 40 CFR 6, and include preparation of an Environmental Impact Statement (EIS). However, according to EPA's recent feasibility study guidance, remedial actions under CERCLA are exempt from the EIS requirement if two conditions are met: 1) the remedy complies with NCP requirements at 40 CFR 300.68; and 2) there is sufficient opportunity for public comment. Both of these conditions are expected to be met, therefore there is no requirement for an EIS for activities taken pursuant to CERCLA at the Saltville site.

Government and Public Involvement

Public involvement is required by CERCLA during the FS process and is therefore applicable to the Saltville site. Guidance for achieving this objective may be found in the EPA publication "Community Relations in Superfund: A Handbook." Information on community relation plans (CRPs) and public comment periods on the FS and selection of the remedial alternative are outlined in this guidance document. Use of a CRP (specified at 40 CFR 300.67) and the involvement by EPA and the State of Virginia in the RI/FS review process (NCP, 40 CFR 300 Subpart B) will facilitate meeting the requirements of Executive Order 12372 and 40 CFR 25.

OSHA

Worker safety and health at CERCLA sites is an important element in all response actions. Pursuant to CERCLA 111(c)(6), EPA, the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) are jointly developing a program to ensure employee protection at Superfund sites. 40 CFR 300.38 of the NCP requires that the OSHA requirement be applied to all CERCLA response activities. Existing EPA guidelines for worker safety include:

- Osha Interim Final Standard to protect workers in hazardous waste operations, 29 CFR Part 1910, December 19, 1986.
- EPA Occupational Health and Safety Manuals.

Existing OSHA standards codified in 29 CFR Part 1910 - General Industry Standards and 29 CFR Part 1926 - Safety and Health Regulations for construction are directly applicable to working conditions at Superfund response sites. The NCP requires Superfund remedial actions to comply with all applicable OSHA and EPA requirements.

Archeological and Historic Preservation Act of 1974

Although there are no known prehistoric, historic, or archeological data or materials contained at the Saltville site, Mr. Larsen of the Archeological Research Center in Yorktown, Virginia believes that the North Fork Area is of great potential for archeological significance. The river beds may pose minimal potential for resources but the river banks and surrounding area hold evidence of prehistoric activities as well as civil war artifacts, and 19th and 20th century pottery. Mr. Larsen suggested that specific site location information be sent to his agency for review before any activity begins. In addition, Indian activity is believed to be present in the North Fork region and will need to be investigated, and impacts from remedial alternatives will need to be assessed prior to implementing remedial activities. If this Archeological Research Center determines that significant archeological deposits exist on the Saltville site, the Archeological and Historic Preservation Act will become applicable to the Saltville site and will need to be considered prior to choosing and implementing any remedial alternatives.

Fish and Wildlife Coordination Act, Conservation Act and Advisories

The Fish and Wildlife Coordination Act, et al. requires Federal agencies issuing a permit to modify any body of water to consult with State and Federal wildlife agencies to ensure that resources are appropriately protected. Coordination would be necessary at the Saltville site with a number of State and Federal agencies including the Va. SWCB, the Virginia Marine Resource Commission, Virginia Commission of Game and Inland Fisheries, and potentially the Corps of Engineers. Coordination would be necessary for those alternatives which may impact the NFHR.

It should be noted that the Saltville site is bordered, in part, on the north by the Clinch Mountain State Wildlife Management Area (CMSWMA). The Virginia Commission of Game and Inland Fisheries has jurisdiction over this State natural resource. Dr. Jack Randolf of the Commission requested that a letter detailing any proposed alternatives that may impact the CMSWMA be sent to him for review.

B. Screening of Remedial Technologies

In this section of the Saltville ROD, general response actions are identified and remedial technologies are screened, in order to identify the most technically feasible remedial technologies that could be used to formulate remedial alternatives for the site. Table 3.1 provides a summary of both those source control and management of migration general response actions and associated remedial technologies identified for the site.

Factors used in Screening Remedial Technologies

Technical Criteria

- applicability to site conditions
- applicability to waste characteristics
- effectiveness and reliability
- implementability

- Environmental and Public Health Criteria

Cost Criteria

- increased cost offering no greater reliability or effectiveness.

- increased cost offering no great protection of public health or environment as established by criteria.

- Institutional Criteria (ARARs)

TABLE 3.1. SUMMARY OF GENERAL RESPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES IDENTIFIED FOR THE SALTVILLE WASTE DISPOSAL SITE

		Remedial Technologies
A.	**Source General Response Actions**	
	1. No Action	Continue existing sampling program beyond 4/26/88; maintain existing runon controls & cap.
	2. Containment	Capping/Covers
	3. Diversion	Surface Water Runon Controls
	4. Removal (Complete/Partial)	Excavation
	5. Treatment	
	(a) Waste Pond Material	
	1. In situ	Chemical Stabilization and enhanced leaching
	2. Onsite/Offsite	
	(b) Pipe discharge	Physical/Chemical/Biological Wastewater Treatment
	6. Disposal (Onsite/Offsite)	Land disposal
B.	**Management of Migration General Response Actions**	
	1. No Action	Continue existing sampling program/ban within NFHR
	2. Containment	Capping, grouting/seals and dikes (dams)
	3. Diversion	Floodwalls/levees, berms/dikes, etc.
	4. Removal (Complete/Partial)	Mechanical, hydraulic and pneumatic dredging
	5. Treatment	Chemical Stabilization
	6. Disposal (Onsite/Offsite)	Land disposal

The following provides a description of remedial actions that will be screened.

Capping

Capping of waste materials is a proven technology for minimizing surface water infiltration. Capping is viable for Waste Pond 5 due to its potential ability to prevent large amounts of surface water (i.e. precipitation and surface water run-on) from infiltrating through the sludge and migrating into the NFHR. It has been estimated by GCA, the contractor for the RA/FS (see Appendix 2), that if infiltration through the sludge is prevented (i.e., through use of a capping technique), flow from the outfall of Waste Pond 5 could be reduced by approximately 80 percent on average (from 0.05 cfs currently, to 0.01 cfs). As such, various capping technologies have been considered for this site, and are listed, described and screened. Table 3.2 lists the types of caps that are potentially applicable to Waste Pond 5 at Saltville.

TABLE 3.2. CAPPING TECHNOLOGIES EVALUATED FOR THE SALTVILLE WASTE DISPOSAL SITE

Compacted Soil
Clay soil compacted to low permeabilities
Flexible Membrane Liner
HDPE
PVC
HyPalon
Multilayer Cap
RCRA Cap
Admixed Liners
Hydraulic Asphalt/Concrete
Soil/Cement
Soil/Asphalt
Sprayed-On Linings
Soil Sealants
Man-made Structures
Dome
Roof Structure

Table 3.3 summarizes the screening of the capping remedial technologies evaluated. Based on the evaluation of capping technologies presented above, it it appears that the most feasible cap is a Flexible Membrane Liner (FML) designed to endure the stresses that maybe induced by Waste Pond 5. This capping technology is the most feasible because of its demonstrated performance record and particularly due to its lightweight nature, its ability to endure stresses induced by differential settlement, the relative ease in constructing the cap and the relative short amount of time needed to meet the remedial objective.

Although under normal conditions other designs may offer more protection for Waste Pond 5, FMLs appear to be the only capping technology that could remain effective with relatively minimal maintenance in the longer term.

It should be noted that the use of a multilayered cap could be potentially applicable to the site. However, due to the extent of site preparation that is needed to install the cap (i.e. preconsolidation) and the difficulty in implementation, a lightweight flexible membrane liner is more feasible for this site.

Compacted soil caps are relatively heavy and possess no tensile strength. Therefore their usefulness as a low permeability cap for Waste Pond 5 is limited.

Admixed Liners, Sprayed-on Liners and Soil Sealants all are limited in demonstrated performance. Furthermore, since they would adhere to the surface of the sludge, cracking would likely occur under the slightest amount of sludge settlement.

Large Man-made Structures would be difficult to construct at Waste Pond 5 due to the size of the site and topography and nature of soils around the perimeter of the site.

TABLE 3.3. SUMMARY OF CAPPING TECHNOLOGY SCREENING

Technology	Screening Factors	Feasible
Completed Soil Cap	1. Very heavy 2. Possesses no tensile strength and therefore will fail if settlement occurs. 3. Would require preconsolidation	No
Flexible Membrane Liner	1. Proven to be effective in waste containment applications 2. Lightweight 3. Possesses tensile strength and elongation potential 4. Relatively easy to implement 5. Relatively short amount of time needed to meet remedial objective 6. Can be expected to stay intact for 50 years 7. Easy to repair	Yes

Multilayered Cap	1. Very heavy 2. Would require preconsolidation 3. Difficult to implement	No
Admixed Lining Materials	1. Limited experience 2. Brittle - very likely to crack	No
Sprayed-On Linings	1. Limited experience 2. Difficult to install flawlessly 3. cracking is likely	No
Soil Sealants	1 Limited experience 2. Degraded by freeze-thaw,No wet-dry cycles 3. Likely to crack	
Man-made Structures	1. Limited experience 2. Soil around perimeter of site may not support a structure.	No

Surface Water Runon Control

Surface water runon controls are appropriate technologies to be considered as a means of reducing mercury discharges from Waste Pond 5 that are caused by the erosion of sludge due to surface water runon/runoff. In addition, surface water runon control measures would aid in reducing the transport of mercury contaminants to the groundwater, and eventually the NFHR, caused by surface water infiltration of subsurface sludge layers.

GCA has estimated, based on previously reported data, that approximately 70 million gallons of surface water could drain onto Pond 5 each year in the absence of any surface water control/diversion systems. As such, a partial surface water runon control system was installed in April 1983 (per the requirements of the "Special Order'') to collect approximately 75 percent (104 acres of the total 139 acres) of the drainage area located along the western edge of Waste Pond 5.

Table 3.4 lists five surface water runon control technologies. These technologies are described in detail and then screened in this subsection in order to assess their feasibility to the Saltville site relative to diverting the remaining, uncontrolled amount of surface water drainage entering Waste Pond 5.

TABLE 3.4. SURFACE WATER RUNON CONTROL TECHNOLOGIES EVALUATED FOR THE SALTVILLE SITE

Remedial Technologies

- Dikes and Berms
- Diversion Trenches and Ditches
- Chutes and Downpipes
- Terraces and Benches
- Seepage Basins and Ditches

Upon completion of the preliminary screening process, it was determined that three surface water runon control technologies are applicable technologies to be considered for implementation at Waste Pond 5. The three applicable technologies are listed in Table 3.5, along with the screening factors which eliminated those two remaining surface water control technologies.

TABLE 3.5. SUMMARY OF SURFACE WATER RUNON CONTROL TECHNOLOGIES SCREENING

Surface Water Runon Control Technology	Feasible to Waste Pond 5 as a RunOn Control Technology	Significant Screening Factors
Dikes and Berms	No	Better suited as a temporary or emergency measure. Drainage area restricted to a 5 acre maximum.
Diversion Trenches and Ditches a. upgrade current system b. new channel construction	Yes	Partial diversion trench in use with limited success since 1983. Conveys collected water directly to NFHR. Synthetic liner and/or stone lined flow channel resistant to erosive forces of flowing water.
Chutes & Downpipes	Yes	Integral part of diversion trench system due to surface elevation of Pond No. 5. Concrete lined gabion chute currently in use at the site.
Terraces & Benches	Yes	Potentially suitable for construction in heavy wooded, steeply sloped up slope area to convey water flow into a larger diversion trench.
Seepage Basins and Ditches	No	Limited available space. Diverts surface water to subsurface strats. May increase water infiltration of sludge and increase mercury flow to ground water which discharges into the NFHR.

Excavation

The National Contingency Plan requires that source removal be evaluated as a remedial option. At the Waste Pond 5 site, source removal would involve the excavation and removal of all or part of the estimated 4,000,000 cubic yards of mercury-laden sludge currently impounded in a 79 acre pond.

Excavation and removal of wastes and contaminated materials typically involves the use of conventional heavy construction equipment and well-established removal techniques. Table 3.6 presents a list of the construction equipment commonly used for excavation and removal actions.

TABLE 3.6. EXCAVATION AND REMOVAL EQUIPMENT

- Backhoe
- Dragline
- Clamshell
- Scrapers
- Industrial Vacuum Loaders

Upon completion of the preliminary screening process, it was determined that source removal by means of full or partial excavation of the sludge blanket is not an applicable remedial action technology for Waste Pond 5. Although two excavation technologies (draglines, dozers and loaders) are technically feasible, the potential health risks posed by elevated mercury vapor concentrations during sludge excavation justify their being eliminated from further consideration as an applicable remedial option. The short term risk outweighs the long term benefit.

A summary of the excavation technologies considered and significant screening factors is presented in Table 3.7.

TABLE 3.7. SUMMARY OF EXCAVATION TECHNOLOGIES SCREENING

Excavation Technology	Feasible to Waste Pond 5	Significant Screening Factor
Backhoe	NO	Length of time required for full/partial excavation unsatisfactory. Potential adverse health effects caused by elevated mercury vapor concentrations associated with sludge blanket disturbances.
Dragline	NO	Potential adverse health effects caused by elevated mercury vapor concentrations associated with sludge blanket disturbances.

Clamshell	NO	Specialized piece of equipment not suited for high production excavation.
Dozers and Loaders	NO	Potential adverse health effects caused by elevated mercury vapor concentrations associated with sludge blanket disturbances.
Scrapers	NO	Better suited for removal/ grading of surface cover than for excavation to depths required at Saltville.
Industrial Vacuum	NO	Better suited for liquid removal than semi-solid/solid material excavation.

Disposal

Onsite Disposal--

This option would involve removal of the sludge in Waste Pond 5 and disposal elsewhere onsite. The only area on Olin property that could contain the waste is Pond 6. However, it is not likely that Pond 6 has the capacity to contain the large volume of sludge in waste pond 5. Even if it does, structural problems with the dike and underlying sludges are likely to be encountered. Presently, Pond 6 has not been identified as a problem area at Saltville. In view of this fact it is reasonable to avoid disturbing the material in Pond 6.

Offsite Disposal--

Landfilling is a commonly used technology for the disposal of hazardous wastes. State-of-the-art RCRA landfill designs include double-liner systems that have been demonstrated to provide adequate protection of the environment. At Saltville landfills could be used to contain sludges if these materials could be excavated from Waste Pond 5. However, there are a few waste characteristics that may make this alternative difficult to implement.

One of the most obvious characteristics that affects implementability is the large volume of sludge that exists at the site. If 69% of the mercury were to be removed from the pond, more than 800,000 cubic yards of material would require disposal after excavation. The removal of ninety-two percent of the mercury would require excavation and disposal of more than 2,200,000 cubic yards and the removal of all of the sludge would require excavation and disposal of more than 4 million cubic yards of sludge. To contain the sludges excavated from the pond, extremely large landfills must be available or must be built offsite. Most commercial facilities do not have the capacity to manage such volumes of waste. Consequently it is most likely that an offsite facility will have to be built in order to implement this technology. Costs

for building such a facility will be significant in view of the large volume of waste. Another characteristic of the sludge that affects implementability is its water content. The sludge is reported to have a high water content and is saturated over much of its depth.

Current RCRA regulations require that wastes containing free liquids must be dewatered or stabilized before land disposal. Consequently, all sludges would have to be dewatered or solidified before disposal.

In addition, offsite disposal without treatment is the least preferred option.

Treatment (Wastewater Pond Discharge)

SARA requires that alternative technologies and resource recovery options be assessed to the maximum extent practicable. In additon treatment technologies should be considered. As indicated in Section 3 of the FS, the contaminant at the site which is most toxic, and most mobile in the environment is mercury. Other metals such as arsenic, cadmium and lead are also evident. However, since mercury is the primary contaminant of concern, literature research for this task was focused on treatment technologies for the removal of mercury from wastewater. Table 3.8 presents two remedial response actions that have been developed for implementation at the Saltville site with a corresponding compendium of liquid waste treatment technologies, assembled from literature reports, that have seen actual application to mercurybearing wastewaters. Although Table 3.8 only presents demonstrated treatment technologies, it should also be noted that emerging treatment systems which include combinations of the treatment technologies provided in Table 3.8, were also reviewed. These systems are not discussed in this document because, in general, they have not been demonstrated beyond the pilot-scale size and data is not available on their cleanup level.

TABLE 3.8. SALTVILLE WASTEWATER REMEDIAL RESPONSE ACTIONS

Remedial Response Actions	Treatment Technologies
Chemical/Physical Treatment of Onsite Contaminated Wastewater	Activated Carbon Adsorption, Chemical Oxidation: Chemical Precipitation; Chemical Reduction; Coagulation and Flocculation: Electrodialysis; Evaporation; Filtration; Flotation; Flow Equalization; Ion Exchange; Oil separation; Reverse Osmosis Sedimentation; Sludge Treatment; Ultrafiltration
Biological Treatment of Onsite Contaminated Wastewater	Activated Sludge; Lagoons

Table 3.9 presents the results of the preliminary screening, with a synopsis of significant screening factors. Upon completion of the preliminary screening process, it was determined that, as shown in Table 3.10A, six technologies are applicable as primary treatment technologies for remediation of the Saltville wastewater. Table 3.10B lists technologies that are applicable as support treatment technologies potentially necessary to employ in order to assume primary treatment effective operation. As is evident from Table 3.9, no biological wastewater treatment technologies are viable. Therefore, the remdial response action "Biological Treatment of Onsite Contaminated Wastewater" is eliminated.

TABLE 3.9. SUMMARY OF REMEDIAL TREATMENT TECHNOLOGIES SCREENING

Remedial Treatment Technology	Feasible to Saltville Muck Pond No. 5 Leachate/Discharge as a Primary Treatment Technology	Significant Screening Factors	Applicable Support Technology
CHEMICAL/PHYSICAL			
Activated Carbon Adsorption	Yes	Although more suitable for adsorption of nonpolar organic molecular pollutants, Carbon Adsorption has been retained due to the great surface affinity of mercury, and its ability to function as a combination filter/adsorber.	Yes
Chemical Oxidation	No	Mercury in Saltville wastewater has already been oxidized; mercuric ion is more mobile than lower oxidation state ions.	No
Chemical Precipitation	Yes	Precipitation of metallic hydroxides or sulfides is well suited to Saltville's inorganic, soluble discharges. Quality of residuals in treated effluent and solid waste will influence selection. Chemical precipitation is often associated with oxidation or reduction processes. Sulfide precipitation is better for chlor-alkali point source category.	No
Chemical Reduction	Yes	Chemical Reduction is a well-developed technology. Sodium borohydride process may be capable of supporting mercury recovery, but may introduce undesirable chemicals into effluents. Quantity of residuals is less volumous than other technologies.	No

TABLE 3.9 (continued)

Remedial Treatment Technology	Feasible to Saltville Muck Pond No. 5 Leachate/Discharge as a Primary Treatment Technology	Significant Screening Factors	Applicable Support Technology
Coagulation/ Flocculation	No	Use of polymers and physical operations of coagulation/ flocculation will not address the majority of mercury mass. Although potentially effective due to mercury surface affinity, it is not as suitable as competing technologies, since it focuses on colloidal mercury. A good "support" technology.	Yes
Electrodialysis	Yes	Potentially applicable to soluble mercury. No chemicals are added to wastewater by process. Allows recovery of mercury. Potential problems with membrane fouling.	No
Evaporation	No	More suited for sludge treatment. Also, mercury volatility would need to be addressed, depending upon the heat rate applied.	Yes
Filtration	No	More suited to suspended solids. A good "support" technology.	Yes
Flotation	No	More suited for colloidal or oily wastewater. A possible "support" technology.	Yes
Flow Equalization	No	Not applicable as a primary technology. A good "support" technology.	Yes

TABLE 3.9 (continued)

Remedial Treatment Technology	Feasible to Saltville Muck Pond No. 5 Leachate/Discharge as a Primary Treatment Technology	Significant Screening Factors	Applicable Support Technology
Ion Exchange	Yes	Potentially applicable to largely soluble, inorganic mercury wastewater. Potential for mercury recovery exists. Sensitive to fouling by suspended/colloidal particles.	Yes
Oil Separation	No	Only applicable to oily wastewater; Saltville wastewater has no oil.	No
Reverse Osmosis	Yes	Reverse Osmosis may allow mercury recovery. Colloidal fouling of the membrane may be a problem; will need "support" technologies. Addresses removal of TDS.	No
Sedimentation	No	Although an important "support" technology, it is not suited for removal of colloidal or soluble mercury. It is frequently used on conjunction with precipitation technologies for physical-separation of precipitants from wastewater.	Yes
Sludge Treatment	No	Not applicable as a primary technology. A good "support" technology.	Yes
Ultrafiltration	No	Ultrafiltration requires higher molecular weight solutes or colloids beyond that of the inorganic, soluble mercury complexes prevalent in the Saltville site drainage/leachate. It may be a potential "support" technology.	Yes

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TABLE 3.9 (continued)

Remedial Treatment Technology	Feasible to Saltville Muck Pond No. 5 Leachate/Discharge as a Primary Treatment Technology	Significant Screening Factors	Applicable Support Technology
BIOLOGICAL			
Activated Sludge	No	Saltville wastewater is largely inorganic. Therefore, no carbon source for activated sludge processes. Also, Saltville wastewater has a very high TDS level which would impact microbial viability.	No
Lagoons	No	Saltville wastewater is largely inorganic, with elevated TDS levels. Lagoons primarily treat organic wastewaters by oxidative processes, with mercuric adsorption and absorption incidential to organic treatment. Saltville wastes cannot support this microbial-based treatment process.	No

TABLE 3.10A. APPLICABLE PRIMARY TREATMENT TECHNOLOGIES

Activated Carbon Adsorption
Chemical Precipitation
Chemical Reduction
Electrodialysis
Ion Exchange

TABLE 3.10B. APPLICABLE SUPPORT TREATMENT TECHNOLOGIES

Activated Carbon Adsorption
Coagulation/Flocculation
Evaporation
Flotation
Flow Equalization
Ion Exchange
Sedimentation
Sludge Treatment
Ultrafiltration
Filtration

Treatment (Waste Pond Material)

Enhanced Leaching--

Under current conditions, GCA has estimated that it may take thousands of years for mercury to be completely leached from Waste Pond 5 by precipitation falling on its surface. Enhanced leaching technology ofers a means to accelerate the rate of leaching, speeding the rate of cleanup. This technology involves application of reagents which will solubilize, and thus mobilize, otherwise insoluble mercury compounds in Waste Pond 5. This technology is currently in the laboratory development stage (U.S. EPA, 1984), and is not known to have been used previously for cleanup at hazardous waste sites. Enhanced leaching technology will be described and its applicability for use at the Saltville site assessed below.

Key parameters influencing mercury solubility include pH, oxidation-reduction (redox) potential, and the presence of solubilizing ligands. At acidic pH values and oxidizing conditions with moderate to high chloride concentrations, soluble mercury can reach very high concentrations in the form of $HgCl_2$ and HgC_3. Addition of high concentrations of the ligand sodium sulfide results in the formation of soluble polysulfide species. Other combinations of pH, redox potential, and ligand concentrations can also produce high concentrations of dissolved mercury.

Application of reagents at the Saltville site would probably be accomplished through use of a spray irrigation system. The spray system network could be floated out onto the pond surface using plywood mats to distribute weight. Reagents would be mixed with water drawn from the NFHR, and pumped onto the pond surface via the spray system. The water/reagent mixture would then infiltrate the sludge, displacing pore water through microscopic hydrodynamic dispersionand thermal diffusion processes. This pore water exchange may be maximized by maintaining sludge saturation between 85 to 92 percent. Ideally, the reagent will then react with insoluble mercury compounds in the sludge to form soluble compounds. The resulting solution containing dissolved mercury will percolate downward through the sludge unti it reaches the water table. Groundwater flowing down gradient will transport the solubilized mercury toward the NFHR. A well point system located in pond 5 along and near the dike will intercept the contaminated groundwater by creating drawdown in the water table, preventing contamination from entering the river. Water drawn from the pond in this fashion will be treated in an onsite treatment system. Treatment system effluent will be monitored for mercury and other parameters and discharged to the NFHR.

The main advantage of implementing this technology is that, ideally, the source of mercury contamination will be completely eliminated at completion of operation. Other technologies leave the threat of future exposure and release of contaminants due to the continued presence of mercury in pond 5. There are, however, several factors which may prevent effective implementation of this technology at the Saltville site, as well as possibly serious adverse impacts which may preclude adoption of this technology.

A major factor in considering this technology is the potential for serious adverse environmental impacts in the event of technology failure. Should the well point contaminant collection system prove to be inadequate, or should for any reason malfunction, a concentrated slug of solubilized mercury would enter the NFHR. This would undoubtedly result in substantial environmental damage, as well as greatly increase the current concentration and extent of mercury contamination. Although the potential for system failure may be low, it should carry substantial weight in consideration of this technology because of the severity of the adverse impacts which would result.

A problem involving the implementation of this technology may also preclude its adoption. Application of solubilizing reagents may not be effective due to the presence of large cracks and gullies in the waste material in pond 5, some of which extend to depths of 10 feet. The majority of the water-reagent mixture would, upon application, travel downward through the cracks because they are the path of least resistance to flow. Thus, the reagents would effectively bypass much of the mercury contamination in the top ten feet of sludge, precluding its solubilization and subsequent removal. Rehydration or the surficial sludge by flooding Pond 5 would require stabilization of the dike due to the added pressure upon it from the additional water in Pond 5. It may not prove to be worthwhile to stabilize the dike if the amount of added effectiveness of flooding Pond 5 is unknown.

The effectiveness of enhanced leaching is related to the extent to which the reactions involved go to completion, and to the extent that soluble species of mercury are formed by each reaction. It may not be possible to lower the current pH of pond 5 (11 to 13) to a level necessary to effect solubilization of insoluble mercury compounds because of the large quantity of calcium carbonate (limestone) in pond 5. The calcium carbonate would serve to buffer the pH, maintaining it at its current pH despite the additon of acids. A problem regarding the metbod of adding large quantities of sodium sulfide to form soluble polysulfides is that large quantities of insoluble mercuric sulfide (HgS) would be formed as well. Furthermore mechanisms describing any of these reactions are not well defined in the literature indicating a substantial degree of uncertainty as to what products will be formed by any reaction.

In summary, enhanced leaching technology may result in serious adverse environmental impacts, may be technically unfeasible to implement, and has no been demonstrated to be effective. Therefore, at this time, this technology is not recommended as a viable technology for implementation of the Saltville site.

In-Situ Chemical Stabilization--

Chemical stabilization involves the introduction into waste matrial of a chemical agent which combines with toxic materials to form compounds that are not soluble in ground water. The leachability of the waste is reduced because the toxic materials are precipitated or otherwise immobilized. In-situ stabilization involves introduction of chemical reagent into the intact material of the waste site by surface infiltration or injection.

Chemical stabilization of mercury wastes is a new and untested technology. When Olin Corp. first proposed the in-situ stabilization approach, the physical and chemical properties of the stabilization process were poorly understood. The Olin Chemicals Process Division performed a series of laboratory column tests to dentify potential reagents. The chemicals tested were calcium sulfide (CaS), sodium thiosulfate ($Na_2S_2O_3$). These chemicals act by combining with mercury in the waste to form insoluble complexes. The exact chemical species present in the untreated and treated wastes have not been determined.

As a result of the Olin laboratory tests, sodium thiosulfate was identified as the optimum stabilizing agent due to its rapid action, high water solubility, low toxicity, commercial availability and low risk of formation of polysulfide byproducts.

The theoretical efficency of chemical stabilization with $Na_2S_2O_3$ was demonstrated by means of pilot-scale column tests in which the mercury concentration in the column effluent wss reduced to approximately 100 ppb, or 5 percent of the untreated level, by surface application of the chemical.

Based on laboratory column tests, chemical stabilization appeared to show promise as a remedial technology. However, field testing of in-situ stabilization revealed serious problems in applying tbis process at the Saltville site. Effluent mercury concentrations did not differ significantly between treated and untreated test plots. The failure of the stabilization process was attributed to channeling of treatment solution through cracks in the solid waste material.

Based on the uncertainties involved with use of an unproven chemical process, and the demonstrated inability of surface percolation or injection to provide the requisite waste-reagent contact, in-situ stabilization does not appear, at this time, to be a feasible technology for remedial action at the Saltville site.

Above-Grade Chemical Stabilization--

Above-grade stabilization involves the excavation of waste materials from the contaminated site, and treatment of the waste by batch mixing with a complexing reagent. The resulting material is less water-soluble than the untreated waste, and therefore may be stored in a landfill with reduced risk of leaching to ground water.

The chemical technology used for stabilization of mercury wastes is discussed above, under the heading of in"situ stabilization. Briefly, sodium thiosulfate ($Na_2S_2O_3$) has been shown to be effective in reducing mercury levels in leachate from Saltville waste, when tested in laboratory and pilot-scale column experiments. The experiments were designed to test the efficacy of in-situ treatment, and therefore do not address the situation where waste and reagent are completely mixed. The effect of complete mixing would probable be to shorten the required contact time and improve the stabilization of the waste. However, differences in conditions such as the water content and oxygenation of the waste could have an unpredictable effect on the complexing reaction.

The technology used in excavation, reagent application, and mixing of the waste is well understood and in common use in chemical processing applications. The primary characteristic of the waste site that affects this remedial alternative is the volume of waste to be treated. Pond 5 is approximately 80 acres in area, and between 40 and 80 feet deep. The ramifications of treating this huge amount of waste must be considered in a detailed evaluation of the above-grade stabilization alternative.

Sediment Containment

Sediment containment is a general response action formulated for management of migration of mercury contaminated sediments from the NFHR to the surface water and to aquatic biota.

In responding to a situation where bottom sediments are contaminated with hazardous substances, such as the NFHR, it is technically infeasible or economically unreasonable to remove all of the contaminated material from its location in the watercourse. If removal is determined to be an unacceptable singular remedial response, in-situ control and containment measures are often considered. These measures are intended to reduce dispersion and leaching of a hazardous substance to other areas in the water body. They may be temporary or permanent response measures. The use of in-situ methods for permanent containment of hazardous waste contaminated sediments is neither widely practiced nor well-demonstrated. Laboratory and pilot scale testing is likely to be required before these methods can be implemented at a particular site. Permanent containment methods may include use of dikes, caps, or in-situ grouting/sealing.

The potential appears to exist for deployment of dikes and in-situ grounting/sealing, alone or in combination, to the NFHR sediments. Both appear potentially technically feasible. However, as stated above the use of in-situ methods for permanent containment of hazardous waste contaminated sediments is neither widely practiced nor well demonstrated. Although utilized by Olin on a limited segment of the NFHR previously, no performance data has been found documenting the efficiency of the technology. Additionally, caps appear technically infeasible due to the significant scour effects normally associated with mountain stream environments such as the NFHR.

Therefore, in the absence of laboratory and bench scale testing, and resulting data documenting the effectiveness of immobilization of Hg in sediments, sediment contaminant technologies are screened from further consideration for the Saltville site area.

River Diversion

Diversion of a watercourse is an established procedure using readily available technology. Rerouting the existing NFHR would uncouple NFHR sediments, the direct source of mercury to aquatic biota, from the mercury primary transport mechanism, surface water. Direct and indirect uptake by aquatic rorganisms would thus be eliminated, reducing fish flesh mercury concentrations.

Potential technologies for river diversion are:

Downpipes/Chutes

Diversion Trenches/Ditches

Berms/Dikes

Floodwalls/Levees

Downpipes/chutes--

It is technically feasible to size conduits to convey the entire flow of the NFHR at any point within the NFHR drainage regime. Run-on could be routed to the conduits, which could be constructed directly on the existing riverbed grade. However, a number of technical limitations preclude this option for use on the NFHR. Groundwater and run-off would continue to recharge the existing riverbed. This flow would would mobilize Hg, and if collected, would need to be treated or discharged to the downpipe system; treatment of flows averaging 300 cfs for low levels of mercury is not practicable. Therefore, this technology would not isolate sediment Hg from surface water and hence aquatic biota. Downpipe/chutes is thus not technically feasible for application on the NFHR.

Diversion Trenches/ Ditches

Trenches and ditches could potentially be constructed adjacent to the existing riverbed below river grade. This may intercept and drain away waters making the existing riverbed, as well as intercept run-on from the watershed. However, the presence of bedrock at river grade, coupled with NFHR Valley topography rules out the technical feasibility of installation of trenches/ditches below river grade adjacent to the NFHR at a capacity to convey NFHR flows.

Berms/dikes--

Berms/Dikes could potentially be used to direct existing river flow and run-on from the existing riverbed to an alternate channel. The North Fork Holston River valley topography is, however, characterized by steep slopes with alternate channels not available without substantial earth moving. In the event earth moving was successful, dikes/berms would not eliminate recharge of the existing riverbed without engineered measures such as cutoff walls. The presence of bedrock at the river grade precludes use of these measures. Surface water would thus be generated in the present river bed, rendering the technology inapplicable for performance of its intended function for NFHR Diversion.

Floodwalls/levees--

Floodwalls/levees are potentially applicable to NFHR river diversion in support of rechanneling of river flow. However, as is the case with downpipes/chutes, direct recharge of the present riverbed from ground water would preclude the effectiveness of floodwalls/levees, which would contain the river flow above the present riverbed grade. Use of sheet pile cutoff walls, or other engineered measures is technically infeasible due to the presence of bedrock at river grade plus the 80 mile length of river considered. This surface water would still flow in the present riverbed. Floodwalls/levees are thus technically inapplicable to the NFHR diversion.

Sediment Removal

Removal of sediments form natural water bodies and man-made inpoundments is an established procedure using readily available equipment. As indicated previously in this ROD, mercury, the contaminant of concern at Saltville, has migrated offsite into the NFHR, and is concentrated in river sediments that are the primary source of Hg for biota uptake. The RA presented data that support the hypothesis that 0.5 ppm or less Hg in sediments may likely lead to less than 1 ppm Hg fish tissue levels; the 1 ppm level will be adequate to safeguard human health. Additional data presented in the RA indicated that sediments exceed 0.5 ppm Hg at all sampling locations in the NFHR downstream of the Pond 5 outfall; this spans a distance of at least 80 river miles. Sediment removal is thus a method of directly controlling the contaminated sediment currently in existence offsite.

Depending on the physical nature of the sediment, the depth of overlying water, and the flow rate of streams and rivers, the following removal techniques may be applicable:

- Mechanical sediment removal
- Hydraulic sediment removal
- Pneumatic sediment removal

The NFHR constraints and Saltville FS constraints were identified, and the technologies were screened, based on technical feasibility. Mechanical sediment removal is a viable remedial technology for support of this general response action and is used in remedial alternatives formulation. Hydraulic and pneumatic sediment removal technologies have been screened from further consideration due to NFHR specific constraints.

Remedial alternatives were developed to deal with the site by combining those remedial technologies, discussed previously, into more specific remedial alternatives. Remedial alternatives formulated are listed in Table 4. The remedial alternatives were then screened on the basis of implementability, cost, and effectiveness. The screening results are summarized in Tables 4.1 and 4.2. Mechanical sediment removal, alternatives with waste water treatment by chemical reduction, and combinations of management of migration and source control remedial alternatives components (other than No Action) were screened from further consideration (For further detail on this screening refer to the Saltville FS, Chapter 4, pages 4-17 to 4-30.)

C. Remedial Alternatives Considered in Detail

There are objectives of any remedial action(s) to be undertaken at the Saltville Site. The remedial action (s) must be consistent with the NCP and comply with SARA. Subpart F of the NCP (Section 300.68) states that remedial action(s) must contribute to an effective approach which will minimize and/or mitigate the threats to public health, welfare, and the environment. Under SARA there are new requirements to be considered in addition to the requirements of CERCLA for selecting the most appropriate remedial action for implementation.

The major new provisions added to the law include a strong preference for permanent solutions and a requirement that all onsite remedial actions attain legally applicable or relevant and appropriate Federal and state standards, requirements (ARARs).

In addressing permanence and long-term effectiveness of remedial actions EPA must consider the following:

- long-term uncertainties of land disposal;
- goals and requirements of the Resource Conservation and Recovery Act (RCRA);
- reduction of mobility, toxicity, or volume;
- short and long-term potential for adverse human health effects;
- long-term maintenance costs and replacement costs;
- potential threat to human health and the environment from the excavation, transportation, and redisposal, or contaminant of hazardous substances or pollutants or contaminants.

SARA establishes a preference for remedial actions that utilize treatment to permanently and significantly reduce the volume, toxicity, or mobility of hazardous substances. Offsite transport and disposal without treatment is the least preferred option where practicable treatment technologies are available.

For the purposes of this ROD, four alternatives incorporating the technologies considered in detail were evaluated for remedial action. These four alternatives are as follows:

1) No Action
2) Upgrade runon controls with ditches/berms/downchutes

3) Upgrade runon controls with ditches/berms/downchutes and treat pond 5 outfall using either sulfide precipitation techniques or carbon adsorption, and install ground water monitoring systems.
4) Upgrade runon controls with ditches/berms/downchutes, cap ponds with synthetic membrane liner, install ground water monitoring system, and treat outfall using either sulfide precipitation techniques or carbon adsorption.

Alternative 1: No Action

The No Action Alternative is described and analyzed within for comparison purposes with all other alternatives as required by the NCP. As its name implies, the No Action Alterntive involves leaving the site as it currently exists with no additional construction-type work to be performed within or outside the site. However, the No Action Alternative considered in this document does include the continuation (beyond April 1988) of all currently implemented remedial measures specified in the "Special Order."

At present, the Saltville site and the NFHR (offsite area) have undergone three remedial measures, as performed by Olin Corporation. All of these activities have been taken pursuant to the "Special Order" issued by the Common-Wealth of Virginia. Specifically, the Va. SWCB issued this Special Order (dated August 1982) to Olin Corporation concerning the mercury contamination problem. The Order (effective November 10, 1982 but which presently terminates on April 26, 1988) contained the following remedial action provisions (noted by bullets in the text) which relate to the current No Action Alternative:

- Olin shall undertake and complete the diversion of surface water runoff from the western portion of Muck Pond 5 by no later than March 31, 1983 (the "Diversion Project").

A surface water runon diversion channel has been employed with some success since April 1983 at Waste Pond 5. The channel, which receives storm water runoff from a portion (104 acres, 75 percent of total drainage area) of the steeply sloped and heavily wooded 139 acre-total drainage area watershed north of Waste Pond 5, was constructed on a clay-fill bed and lined with an erosion resistent synthetic liner in lieu of stone rip-rap. The existing channel was not constructed to collect surface water runoff from the eastern end of the pond. As such, only approximately 55 million gallons/year of the total 70 million gallons/year of surface water that would drain onto the site is conveyed through the existing channel structure. The remaining approximately 15 million gallons/year continues to drain onto the sludge blanket within Waste Pond 5 from culvert A (not including the eastern area equal to 51 acres of drainage area), see Figure 4.

Additionally, a section of the existing diversion system was routed directly over a portion of the sludge blanket along the northwestern corner of the pond. On 14 February 1984, that section of the channel failed due to sludge settlement below the clay bed. The channel was repaired on 17 July 1984. In April 1987, the diversion ditch failed in several areas. EPA is organizing a sampling effort to determine the extent of contamination by this release.

As an additional part of the surface water diversion system constructed at Pond 5 in 1983, a 5 foot wide, two-stage chute was constructed at the southwest corner of the pond to convey diverted water to the NFHR. The two stages allow for water drops of approximately 40 and 30 feet. The two stages are separated by a stilling basin and 5 foot I.D. concrete culvert which conducts flow under the existing access road. The chute was constructed with structually stable grouted gabions which were then paved over with 3 inches of concrete to protect against the erosion forces of high velocity water flow.

- Olin shall undertake and complete the removal of mercury contaminated sediments from the subaqueous bed of the northern bank of that portion of the river downstream from the Route 634 bridge to a point 1,000 feet downstream by not later than December 31, 1982, and shall complete the site capping and closure of the soil disposal area by May 31, 1983 (the "River Project"). A 1-year extension was provided if necessary approvals and permits were difficult to obtain.

The sediment removal action undertaken by Olin Corporation was completed by January 25, 1983. In order to perform this activity, the NFHR was temporarily diverted through the use of two sandbag cofferdams and a diversion flume located in the riverbed. This enabled excavation, with standard earthmoving equipment, under dry conditions. Approximately 1,300 feet of the riverbed downstream of the Route 634 bridge was isolated. An estimated 7,000 cubic yards of alluvial mercury-contaminated material was removed. A layer of shotcrete was applied to seal cracks and crevices if all contaminated material was unable to be removed.

The work area was restored to its original contour and grade using crushed stone. Material taken from the excavation was mechanically "treated" to remove metallic mercury. Processed material was deposited on the old plant site. A clay cap was installed over the old plant site and topsoil and grass seeding was added along with a storm water diversion system to protect the capped area.

Another project Olin performed during the summer of 1982 consisted of the rip-rapping of a portion of the river bank adjacent to Waste Pond 5. This effort was conducted in order to help stabilize the Pond 5 dike wall since extensive erosion was jeopardizing the integrity of Pond 5.

- Olin shall commence a program of sampling of the mercury concentrations in both the water column of the river and fish therein and shall maintain a Sampling Program for a period of 5 years. Sampling shall commence upon completion of construction of either the "Diversion Project" or the "River Project", whichever occurs first.

The last component of the proposed No Action Alternative involves the current Sampling Program which requires the following activities to be performed by Olin:

1. Fish--A minimum of one sample collection/year for 5 years (beginning in the summer of 1983) with fish collection at each of the following river miles: 98, 77, 72, 59, 36, and 8.0. At least 15 sunfish, 12-20 cm in length, and 15 northern hogsuckers, 23-32 cm in length, are to be collected at each sampling site. Each fish shall be analyzed individually for total mercury in edible muscle using the EPA procedure. Twenty percent of all samples will be split with TVA for analysis. Fish collection will be made by some method other than with Rotenone.

2. Pond 5 Outfall--Daily flow measurements and samples of the outfall will be collected daily (5 days each week) and analyzed for mercury using the EPA cold vapor procedure. The outfall will be sampled and analyzed once each week for TDS. Ten percent of the mercury samples will be split with TVA.

3. Instream--A minimum of three instream sampling studies are to be performed, which will involve measurements of total mercury in water using the gold film analyzer, similar in nature to the recent studies performed by Olin, to demonstrate mercury concentrations in the river water. The portion of the river to be sampled would extend from the Route 634 bridge to a point below the outfall of Pond 5, to include the end of the concrete pad on the river bottom. Each sampling study is to be performed every 2 weeks for a period of 6 months, March though August, inclusive. The 2-week interval need not be precise provided that sufficient sampling at high flow is obtained. These three studies are to be performed during the first 12 month period following the completion of the in-river project, during the third 12 month period, and during the fifth 12-month period. Additionally, biota, both algae and invertebrates, are to be analyzed for total mercury at the beginning of the fifth 12-month period of study.

4. Rainfall Data--Rainfall data shall be provided with all sampling data. This should include rainfall, before, during and after the actual sampling day.

5. Sediment--Sediment samples will be collected annually for 5 years at river miles 98, 77, 72, 59, 36, and 8.0. Three core samples should be collected across the river at each station, and the top inch of the three cores composited and analyzed for total mercury. Samples should be collected during low flow periods. All samples will be split with TVA.

Sampling results are subject to the following sample analysis requirements.

1. Fish - Fish data will be evaluated following each annual collection.

2. Pond 5 - Mercury and hydrological data will be evaluated semiannually until a decision can be made regarding the effectiveness of the diversion ditch.

3. Instream - Instream studies will be evaluated following each of the three studies.

4. Sediment - Data evaluation following each sample collection.

In summary, the above implemented remedial measures are those actions taken to date and which are proposed to be continued under the No Action Alternative. In addition, the continued maintenance of all existing remedial engineered structures (e.g., rip-rap riverbank stabilization, runon diversion, ditch/downchute, cap on old chlor-alkalai plant site, plant site runon diversion), plus all engineered structures whose failure would result in increased migration/transport of mercury to the environment, are included as components of the No Action Alternative in this document.

Performance. The performance of this alternative to effectively discontinue the release and/or migration of mercury contamination from the Saltville site is at best questionable because current analytical results continue to demonstrate the migration of mercury wastes from the Saltville site into the NFHR sediments and biota.

Reliability. Based on the analytical results summarized in the RA, the No Action Alternative shows no demonstrated reliability to effectively minimize or immobilize the mercury-contaminated materials.

Implementability. Implementability of the No Action Alternative is not applicable to the Saltville site because no additional remedial measures are to be implemented.

Safety. Safety concerns during the implementation of the No Action Alternative are no greater than the present safety threats to the Saltville community, nearby communities and the environment. That is, there will be no elevated risk as a result of excavation and/or construction operations; however, the potential for exposure as a result of No Action has not been reduced immediately.

The No Action Alternative does not limit or preclude exposure to mercury via the significant exposure routes identified in the RA. Recent sampling data (1985) indicate that site conditions remain much the same in regards to the contaminant levels detected in the sediments of the NFHR and discharge water from Waste Pond 5. The concentration of mercury in the edible portion of fish tissue remains on the average above 1 ppm. The area of the NFHR below the Saltville Site is still being used by local residents for recreational activities such as fishing, suggesting that exposure to mercury is occurring. As concluded in the RA, the ingestion of fish caught from the NFHR could lead to high mercury exposures and present a significant risk to public health. The No Action alternative would not prevent continued human exposure to high concentrations of mercury via the ingestion of contaminated fish. The No Action alternative is unacceptable in terms of improving and protecting the public health of persons residing around the Saltville Site.

The No Action Alternative includes the continuation of the existing fishing ban and sediment and fish sample anaylsis. This alternative represents the current conditions at the Saltville Site. Under the No Action Alternative the Waste Pond 5 discharge is flowing at a rate or 0.05 cfs with an average mercury concentration of 39 ppb and a peak of 120 ppb. The average daily flux of mercury into the river is 10 g/day. Consequently, the current discharge mercury concentrations are not suitable for aiding in the depuration of mercury from aquatic organisms in the North Fork of the Holston River.

The fishing ban may help limit human exposure to contaminated fish, but this action diminishes the recreational value of the river and requires constant enforcement by state fisheries personnel. More importantly, complete compliance of the fishing ban can not be assumed, suggesting that persons are being exposed to significant levels of mercury. Under the No Action scenario conditions will result in mercury fish tissue levels greater than 1ppm, and will continue to adversely impact the intergrity of the aquatic ecosystem (decrease in species diversity and vitality). The integrity of the aquatic environment of the NFHR is dependent on sediment and surface water mercury concentrations being maintained below the aforementioned criterion. Therefore, the No Action Alternative is not effective in protecting the environment. The FS estimates that this alternative would not have a total capital cost. However, annual O&M costs would be $39,254 with a total present worth cost of $370,044.

Alternative 2: Upgrade runon controls with ditches/berms/down chutes

Upgrading surface water runon controls for Waste Pond 5 at Saltville is a very important remedial alternative component, and possible remedial alternative alone, because of its ability to reduce the quantity of offsite rainfall (surface water runoff/runon) from entering the Pond and subsequently infiltrating into the sludge material. The approach to runon controls, briefly formulated in Section 4 of the FS and described in further detail below, is expected to be completely effective in eliminating runon for the 25-year storm. In addition, the use of supplemental channel freeboard and design using conservative runoff estimates will probably allow for reasonable protection against storms of longer recurrence intervals (i.e., 50-year and 100-year storms).

As discussed earlier the runon control alternative is designed primarily to intercept runoff from the approximate 35 acre Area A north of Pond 5 and the 51 acre area east/northeast of the pond. Figure 4.1, presented earlier, shows these areas and the approximate location of the new runon controls proposed under this alternative.

A description of the runon control routing and construction can be found in the FS on pages 5-7 to 5-11. Figure 4 is a conceptional design of the surface water runon control system.

Performance--

The above described runon control system design is expected to be 100 percent effective in reducing runon to Pond 5 from the 25-year storm. A limited amount of runon (less than 1 percent of the total) may result from the area between the proposed collection system alignment and the edge of the pond. No known site topography or geologic problems appear to be a major factor in the effectiveness of this system.

The useful life of this system, with adequate maintenance, is expected to be 30 years or longer. The drainage channel will have a longer life (50 to 100 years) with proper maintenance. The critical system elements include the 30-inch conduit and the gabion or concrete chute which may erode due to abrasion or acid precipitation action. Neither of these elements will necessarily require replacement after 30 years. However, some slight reduction in system effectiveness may result.

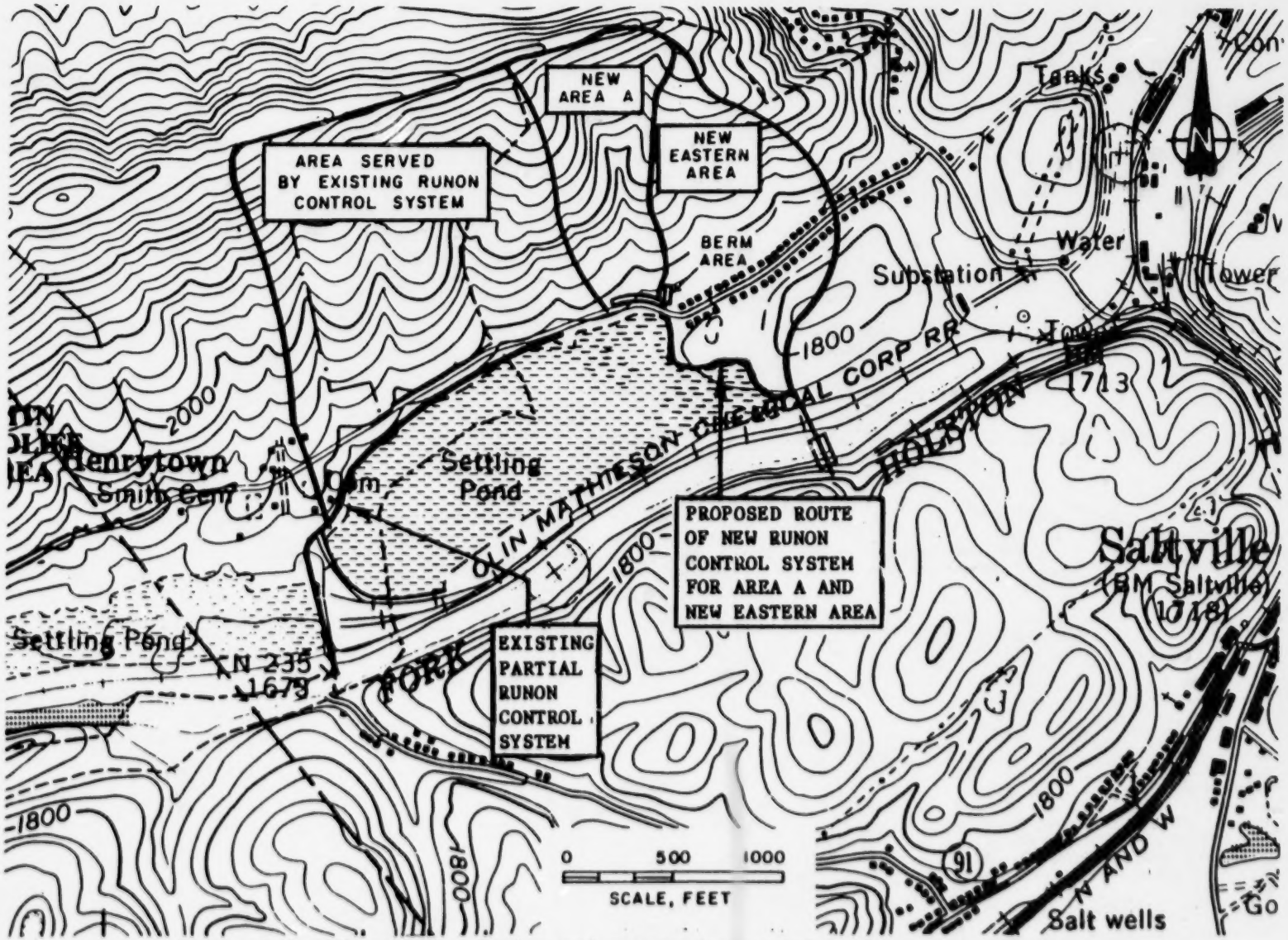

Figure 4.1. Sketch of existing and proposed upgraded surface water runon controls at the Saltville site.

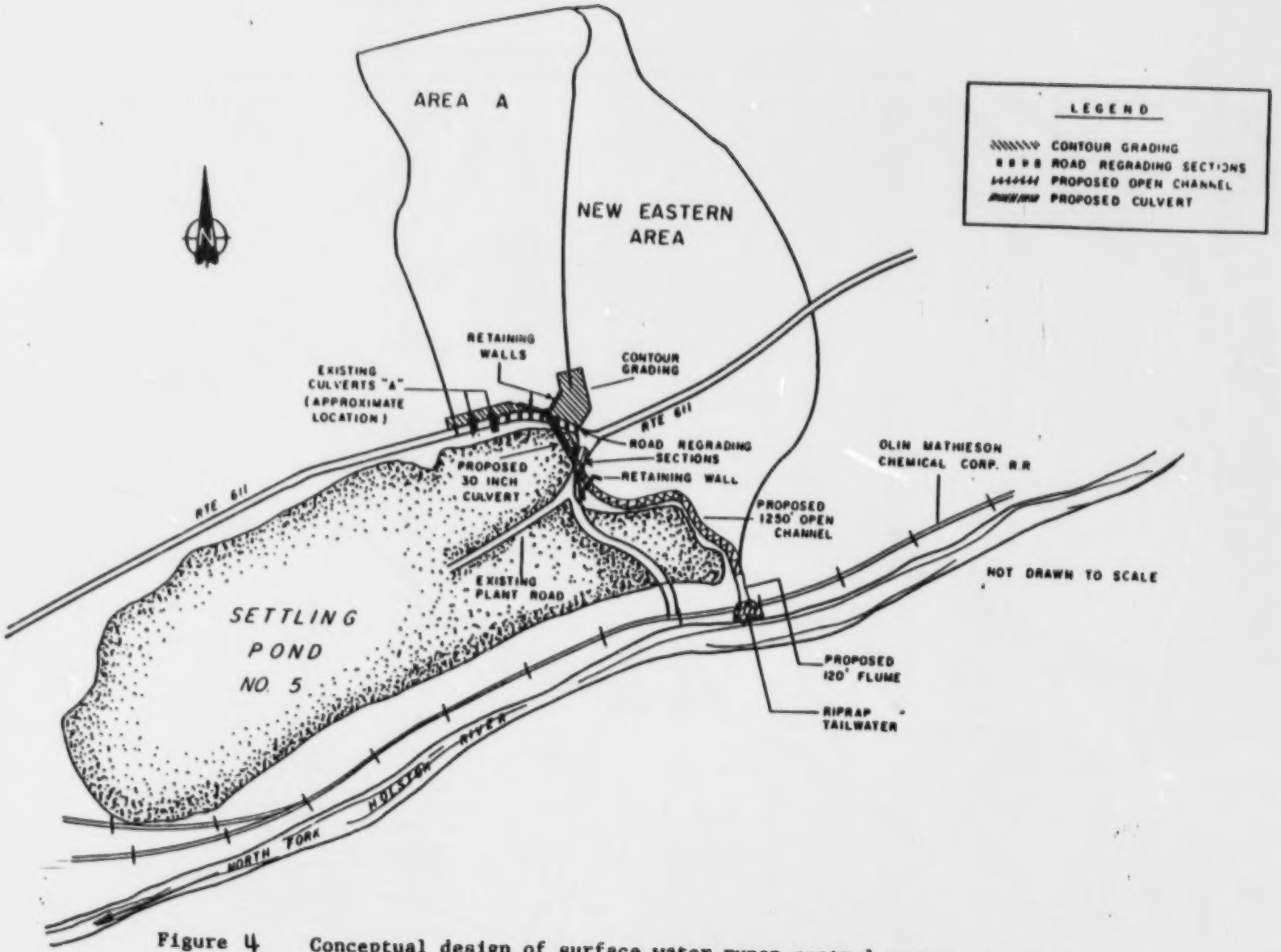

Figure 4 Conceptual design of surface water runon control system upgrade.

Reliability--

The reliability of this system is judged to be high based on the following factors: (1) use of simple principles and gravity flow ensures normal operation most of the time; (2) minimal maintenance requirements; (3) few technical uncertainties is underlying design; (4) design for 25-year recurrence interval.

The probability of the 25-year design storm being exceeded during any given year is 1 in 25. However, this exceedence will not likely result in failure of the system due to safety factors employed in the design. It is in fact likely that the suggested design will handle the 100-year storm without significant failure. Thus, the likelihood of failure may be more accurately stated as 1 in 100.

Implementability--

Based upon the proposed runon control alignment, which does not traverse the pond sludge, the site conditions do not appear to have any serious impediments to the constructability of this alternative. In general the excavation and construction of the runon control system described above is fairly routine. The most complicated element from the standpoint of constructability will probably be the grouted gabion chute. The steepness on the slope, 1:2, may slow excavation, hauling, and placement of the chute. In addition, the grade steepness may require special means for placing the concrete grouting.

It is estimated that implementation of this alternative would be relatively rapid compared with others being considered. Total implementation time is estimated to be less than 6 months including: (1) 2 months for final design and bidding specifications development; (2) 2 months for plan approvals and contract mobilization; and (3) 2 months for construction of the runon control system.

During actual construction it is recommended that construction of the grouted flume be initiated first to allow adequate curing of the concrete. Further construction programs should progress from the downstream elements in the upstream direction to minimize delays caused by adverse weather and runoff. The construction of the first element could be initiated at the same time as the flume since this element will also require cast-in-place concrete.

Safety--

Unlike many other alternatives being considered, safety considerations for implementation of this alternative are fairly routine. Since no excavation on in the wastes will be required, no special protection should be necessary. Also, since excavation cuts are relatively shallow (less than 10 feet) and side slopes are generally flat (1:2), no special concerns regarding bank failure are prominent.

The proposed remedial measures designed to divert overland surface water flow away from Waste Pond 5 are expected to result in a decrease in the discharge flow (from 24 gpm to 18 gpm) from this area into the NFHR. The average and peak mercury concentrations in the outfall will likely remain at the No-Action levels of approximately 39 ppb and 120 pp. Using these mercury concentrations and flow rates in conjunction with the modeling results presented in the RA, it will take a minimum of 14 years for mercury sediment levels to fall below 0.5 ppm. In addition, mercury surface water concentrations will exceed 0.05 ppb during periods of high discharge. These conditions will not result in a rapid depuration of mercury from fish tissue to levels considered to be protective (1 ppm) to public health.

Under this remedial alternatives ingestion of contaminated fish remains the most significant route of exposure. The construction of the ditches, berms and downchutes is not expected to result in worker exposure to mercury from direct contact with contaminated soils or generate contaminated airborne particulates, as construction will not be in an area of known contamination. However, certain worker-safety precautions should be used (respirators, Tyvek suits) during construction, as the proposed construction area is located very close to Waste Pond 5 and other areas of contamination.

This remedial alternative does not provide significantly improved protection of the public health over a No Action alternative from exposure to mercury contamination as levels of mercury in fish tissue are expected to remain above 1 ppm for a minimum of 14 years. Upgrading the existing runon controls will effectively eliminate all overland surface water flow into Waste Pond 5. The reduction in flow onto Waste Pond 5 will result in a decrease in the discharge flow at the outfall area from 24 gpm to 18 gpm. This alternative provides no additional benefit to the protection of the aquatic ecosystem over the No Action alternativ . The construction necessary for this remedial alternative should not adversely impact the aquatic environment at the NFHR. In addition, this upgrading process would occur mainly on the side opposite the rivers edge offering little or no adverse exposure to the NFHR. Although upgrading existing runon controls will effectively eliminate all overland surface water flow into Waste Pond 5. The continual loading of mercury into the NFHR will not serve to effectively contribute to the protection of the environment.

The FS estimates that this alternative would cost $50,052 with annual O&M costs of $42,687; total present worth cost would be $452,459.

Alternative 3: Upgrade runon controls with ditches/berms/downchutes and treat pond 5 outfall using either sulfide precipitation techniques or carbon adsorption and install ground water monitoring systems.

This alternative combines alternative 2 with treatment of pond 5 outfall and includes a groundwater monitoring system. Since Alternative 2 has been discussed previously, this section will focus on the treatment systems. The groundwater monitoring system will have to be designed after the conclusion of a hydrogeological study at the site. It is proposed to reduce mercury discharge quantity by either of three potential treatment alternatives as described in Table 5 and depicted in Figures 5 through 7. Each provides for pH adjustment as a pretreatment step, although this may not be necessary for the sodium sulfhydrate process. Carbon filtration also requires up-front suspended solids filtration. Brine (TDS = 10,800 mg/L) should have no effect on any chemical treatment alternatives are essentially batch systems, while carbon treatment can be operated continuously. A surge tank will be installed within the area of the current outfall structure (within the leachate) while the existing concrete pipe will be plugged. The leachate collected in the surge tank will then be pumped to pH ajustment tanks. The waste pond itself will serve as an equalization basin, to provide regulation of flow which ranges from 5 to 1,400 gpm over the year. Average flow is estimated to be 20 gpm, with the majority of flows less than 100 gpm.

Table 5 TREATMENT ALTERNATIVES EVALUATED FOR THE SALTVILLE SITE

Treatment alternative	Solids treatment mechanism	Dewatering
1. Sodium sulfhydrate	Sulfide precipitation (Hg^{2+} to HgS)	Filter leaf
2. "Sulfex", or iron sulfide (Permutit)	Sulfide precipitation in solids contact clarifier (Hg^{2+} to HgS)	Filter press
3. Carbon filtration	Physical adsorption	None required

Design flow is established at 100 gpm (with two, 50 gpm parallel treatment treatment systems to be provided). These parallel systems ensure a partial backup (to 50 gpm) in case one system breaks down, and allows cleaning and maintenance on one-half of system capacity without shutting down the entire system. A 100 gpm design accommodates the majority of daily flows.

Chemical requirements and sludge production were based on the average flow of 20 gpm. Table 5.3 presents estimated quantities of sludge to be produced by each treatment process. Sludge will be considered hazardous because a waste stream only 15 mg/L in solids containing 39 to 120 ppb is concentrated to a minimum of 35 to 40 percent solids cake. For sulfide processes, much of the sludge generated is comprised of inert filter aid or nonhazardous sulfur precipitate, but these sludges may still fail the EP toxicity leaching test of 0.2 mg/L Hg. Since data is lacking, it seems prudent to adopt this approach as

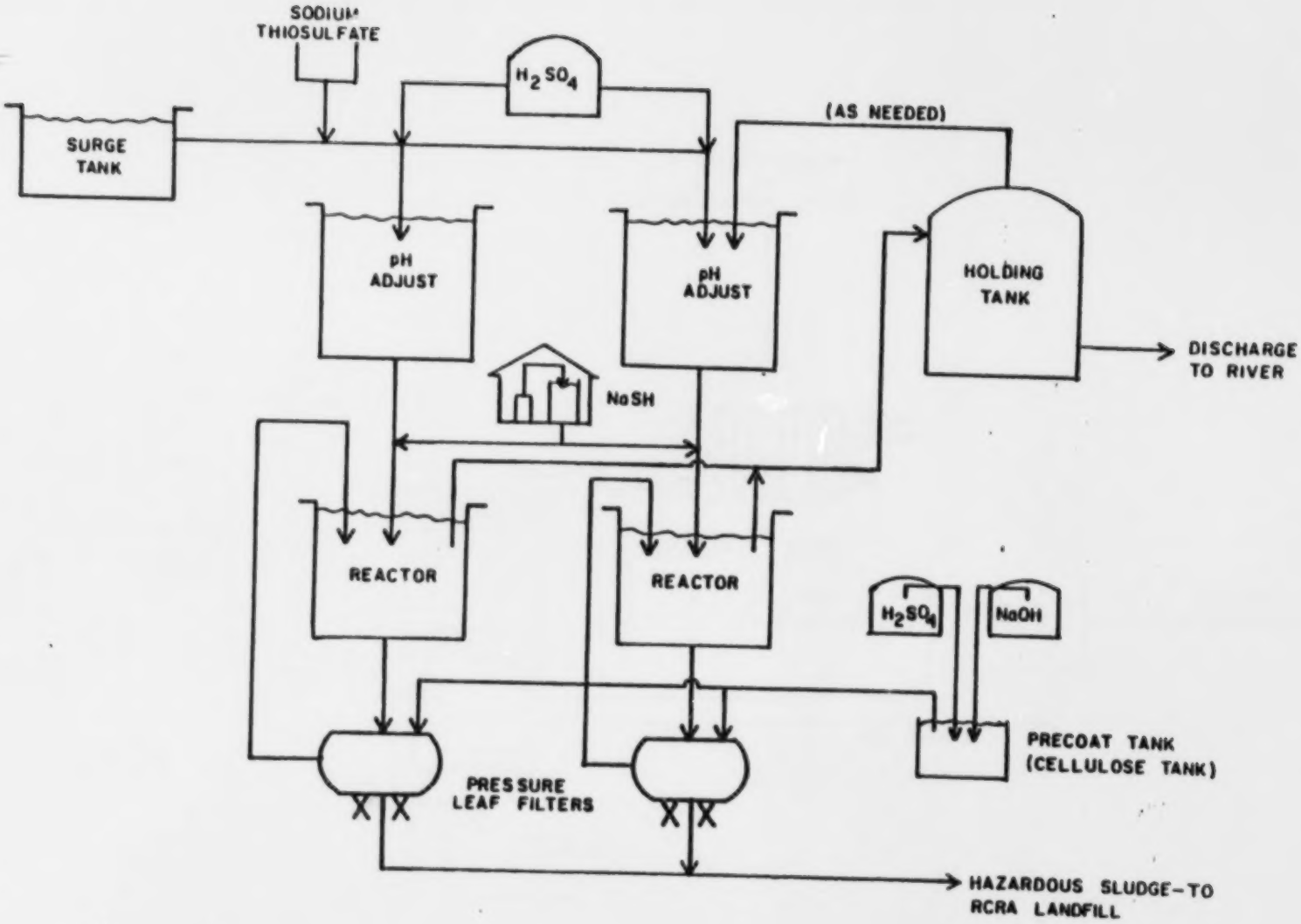

Figure 5 Proposed sodium sulfhydrate precipitation treatment system for waste pond No. 5.

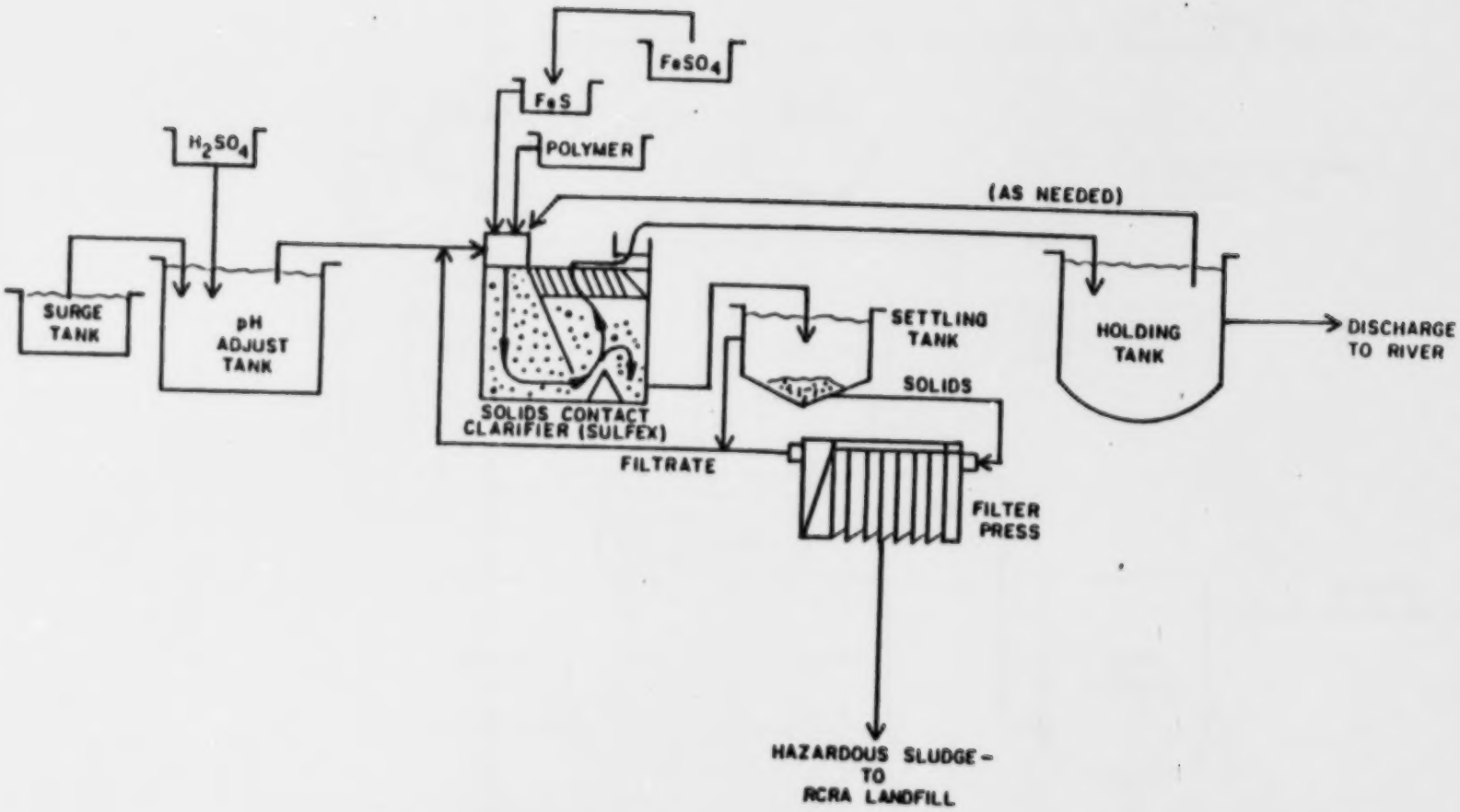

Figure 6 Proposed iron sulfide "Sulfex" precipitation treatment system for waste pond No. 5.

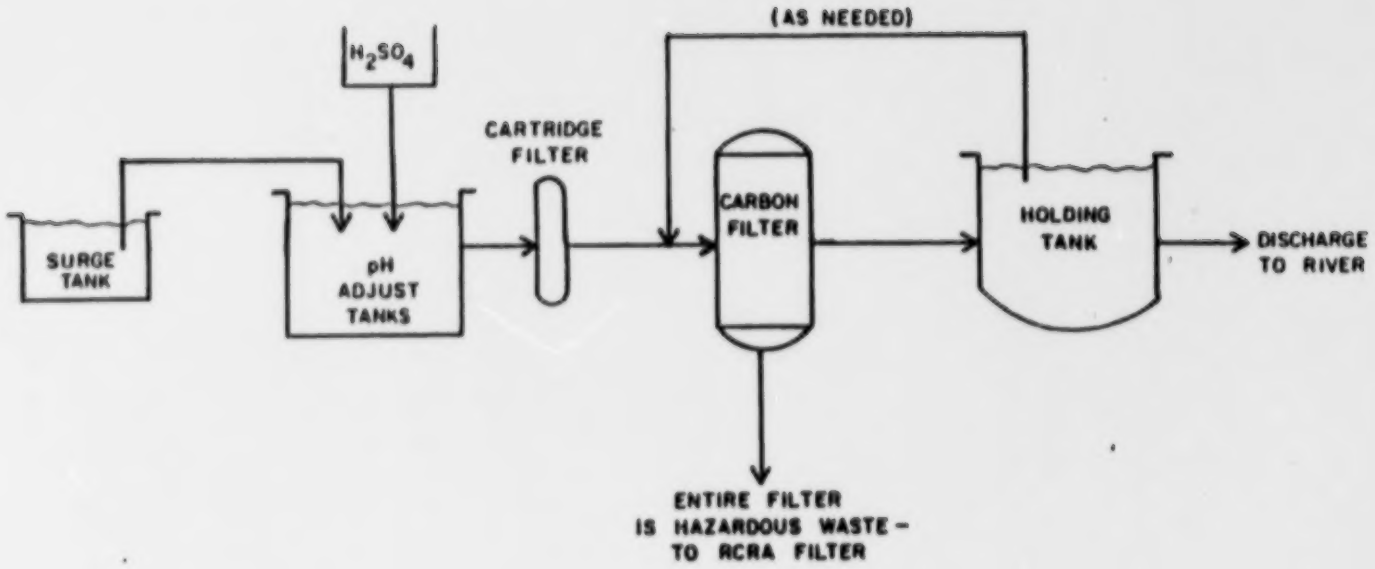

Figure 7 Proposed carbon treatment system for waste pond No. 5.

the worst-case scenario.

TABLE 5.1 ESTIMATED SLUDGE QUANTITIES GENERATED BY EACH REMEDIAL TREATMENT ALTERNATIVE/ ALTERNATIVE COMPONENT

Process	TPY	Cu. yd/yr
NaSH	119	108
FeS	5.5	5.4
Carbon	11	13

Each system has two holding tanks at the end of process treatment which at 36,000 gallons can hold up to 6 hours of maximum flow or 15 hours of average flow. Treated effluent can be held in these tanks for testing prior to discharge, ensuring that the mercury concentration limit has been met. Insufficiently treated effluent will be retreated.

Treatment facilities are proposed for location at elevations 1730 and 1740 between Waste Ponds 5 and 6 (Figure 8) at the Saltville site. Facilities for each alternative will require concrete foundation work covering aporoximately 100 ft x 100 ft, 30 ft x 50 ft of which will be enclosed by a metal-clad and roofed building approximately 15 feet in height. It is assumed facilities are supportable on the existing surface, which formerly supported railroad traffic.

A brief review undertaken on the geotechnical stability of the Pond 5 dike revealed a stable condition for normal situations. The stability of the dike during earthquakes, flooding, and other natural events may be questionable during worst-case occurrences (FS Appendix 5), but those events would happen, at least statistically, at a time beyond the intended treatment system design life of 15 years minimum. The proposed treatment plant location will be above the estimated 100-year floodplain of the river.

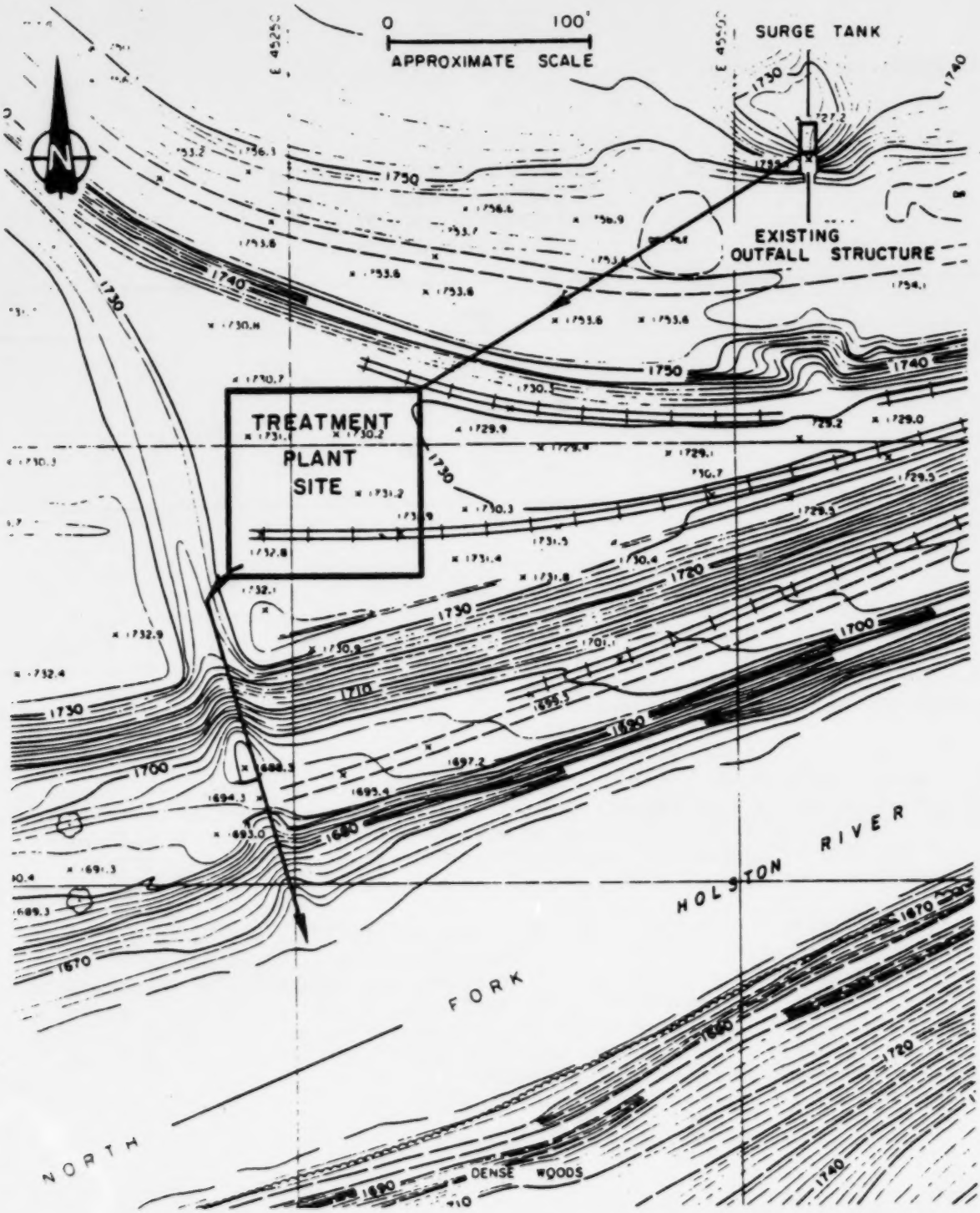

Figure 8 Proposed treatment plant location.

Performance--

Evaluation of performance of a given treatment alternative is based on consideration of its effectiveness and useful life.

Effectiveness--Leachate from Saltville Waste Pond 5 is discharging to the NFHR via a concrete outfall pipe. The pipe intake is located at an approximate elevation of 1,676 feet MSL, tbe lowest point of the Waste Pond, hence serving as a collection point for subsurface water accumulating beneath the entire sludge pond. Discharge pipe invert elevation is 1,666 feet MSL.

It has been determined by GCA Technology Division, Inc. that the current average mercury discharge of 39 ppb (peak discharge of 120 ppb) must be reduced to a mean concentration of less than 20 ppb on a 24-hour basis for a minimum of 15 years. This standard is based on public health and environmental impact considerations, and applicable or relevant and appropriate statutes. Based on previous use and a review of literature, each of the treatment technologies are able to reach the treatment goal of 20 ppb mercury discharge.

Useful life--The projected service life of component technologies varies for each of the treatment alternatives. Some component technologies, such as membrane separation equipment and carbon filters, require replacement at some time during the project design period of 15 years. Significant replacement needs are identified below for each treatment alternative. All other equipment will require only routine mechanical maintenance, which is not discussed.

- Alternative 1: Sodium Salt Precipitation--Will usually require replacement of filter leaf cloth every 3 to 5 years. Cloth is readily available from a number of manufacturers.

- Alternative 2: "Sulfex" (FeS) Process--approximately 20 percent of individual filter press chamber plates will require replacement every 3 years.

- Alternative 3: Carbon Treatment Process-Packaged carbon treatment units will require replacement yearly over the project life. Replacement media and housing are readily available from established manufacturers.

Overall, no significant differences in useful life is anticipated from any of the three treatment systems evaluated above.

Reliability--

Reliability as an evaluation criterion of a treatment process' suitability is concerned with its operation and maintenance (O&M) requirements and demonstrated reliability at sites and conditions similar to the Saltville site.

Operation and maintenance requirements--CERCLA guidance requires evaluation of the proposed treatment alternative on labor and materials availability and their costs, frequency, and complexity of O&M requirements. Alternatives needing frequent or extensive O&M are considered less reliable than technologies without these needs.

° Alternative 1: Sodium Salt Precipitation--Based on a literature review, discussions with vendors, design experience with similar systems for mercury treatment, and a site visit to a chloralkali plant, this process is considered readily operated and maintained by available labor at routine cost. No unusual O&M activities relative to other technologies are required except for control of hydrogen sulfide gas, which is generated upon low pH conditions in reactor tanks. Use of sodium sulfhydrate (NaSH) instead of sodium sulfide (Na_2S) practically eliminates this concern, according to the literature and plant operators, and is also easier to handle and store than Na_2S. This system is considered reliable.

° Alternative 2: "Sulfex" (FeS) Precipitation--The Sulfex process developed by Permutit requires more operator attention to ensure process effectiveness than NaSH precipitation. More chemical storage, mixing and dispensing stages,and a larger number of chemicals are also needed in the Sulfex process relative to NaSH. However, filter aid is not needed at the solids dewatering filter, because the Sulfex reactor has a high solids concentration which allows better natural solids concentration. This contrasts with NaSH precipitation, which requires two to three times more labor to backwash pressure filters to remove accumulated solids. This system is considered reliable.

° Alternative 3: Carbon Treatment--Activated carbon filters used for the mercury feed stream will eventually diminish infiltration capacity and require yearly replacement. Pretreatment filter cartridges also must be changed periodically, e.g., monthly or quarterly. The pH adjustment system will require continual operator attention and maintenance. The entire carbon treatment process will require less O&M labor than any of the chemical treatment technologies. O&M is straightforward and relatively simple, in particular because the replaced cartridge filters and carbon filters involve modular units which are readily removed when spent and rapidly installed when new.

In comparing the three treatment systems relative to reliability, it appears as if the Sodium Sulfhydrate process might have the highest operation and maintenance (O&M) costs based upon the much higher volumes of sludge produced. However, as the next subsection discusses in more detail, O&M costs for the "Sulfex" process are similar because of the more complex treatment process which requires greater operator attention. This, therefore, will likely offset the lesser sludge handling and disposal requirements of the "Sulfex" and Carbon Treatment processes. In all, Carbon Treatment systems will still have lesser O&M requirements than either of the other two treatment systems.

Demonstrated performance--The probability of the success of each technology requires evaluation based on an analysis of its historical performance at similar sites or for similar wastes. A qualitative assessment of each technology requires evaluation based on an analysis of its historical performance at similar sites or for similar wastes. A qualitative assessment of each technology's potential performance is provided below.

a. Sodium Sulfhydrate

This process has been used successfully for the past 2 years at LCP Chemical in Orrington, Maine. Mercury concentration in the outfall discharge is often nondetectable and generally does not exceed 5 to 6 ppb. The analytical limit of detection used to monitor the outfall is 0.5 ppb.

No other system was reported in use in the literature. However, as long as key process variables are carefully controlled (refer to site visit notes in Appendix 3 of the FS), this process should be successful at the Saltville site.
This process is considered to be a demonstrated alternative.

b. Iron Sulfide ("Sulfex")

This process has been demonstrated on many metal-bearing wastewaters, primarily from plating and finishing operations. Currently, over 80 Sulfex installations exist, and metal removals to less than 5 ppb are typically being achieved for most metals. Permutit, manufacturer of the Sulfex process, has reviewed the Saltville leachate and feels that its system is applicable and can reach the required average discharge limit of 20 ppb. As it does now for all its installations, Permutit may be able to provide a performance guarantee that it can meet the 20 ppb limit. This guarantee is based on their experience with mercury removal as one of many contaminants in a mixed waste stream treated by Sulfex, and on an evaluation of expected Sulfex effectiveness.
This process is considered to be a demonstrated alternative.

c. Carbon Filtration

Discussions with Calgon Corporation, a major carbon media manufacturer, have confirmed that mercury can be treated effectively to the discharge limits required for this project. Calgon bases its projections on current and past experience with remaining mercury at similar or higher concentrations to those in the Saltville leachate. This position agrees with the laboratory and pilot-scale testing undertaken by Georgia-Pacific for the EPA in 1974. Their work found that mercury concentrations of 800 ppb and higher were reduced to 10 to 20 ppb after carbon adsorption treatment.

From these considerations, carbon filtration is deemed a demonstrated technology.

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TABLE 4 . REMEDIAL ALTERNATIVES FORMULATED FOR THE SALTVILLE WASTE DISPOSAL SITE[a]

Management of Migration

A. Mechanical sediment removal

B. No Action

Source Control

A. Upgrade runon control with ditches/berms

B. Upgrade runon control with ditches/berms, and treat pond outfall discharge with chemical precipitation.

C. Upgrade runon control with ditches/berms, and treat pond outfall discharge with chemical reduction.

D. Upgrade runon control with ditches/berms, and treat pond outfall discharge with activated carbon adsorption.

E. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and install ground water monitoring (gwm) system.

F. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with chemical precipitation and install gwm system.

G. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with chemical reduction and install gwm system.

H. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with activated carbon adsorption and install gwm system.

I. Treat pond outfall discharge with chemical reduction.

J. Treat pond outfall discharge with chemical precipitation.

K. Treat pond outfall discharge with activated carbon adsorption.

L. No Action.

NOTE

[a]Management of migration can be combined with each source control to formulate 11 additional remedial alternatives.

TABLE 4.1 SUMMARY OF EFFECTIVENESS EVALUATION OF THOSE REMEDIAL ALTERNATIVES FORMULATED FOR THE SALTVILLE WASTE DISPOSAL SITE

Alternative	Reaching 0.5 ppm levels in Sediment	Reaching 0.05 ppb in Surface Water	Time Period Expected to Achieve Criteria Levels	Impact to Ecosystems From Implementing Remedial Alternative	Result in Fish Level >1 ppm metnyl merc
1. No Action (Source Control and Management of Migration)	Will not enhance depuration process	Will not consistently achieve this level	Minimum of 14 years to reach sediment levels only	N/A	No
2. Upgrade Runon Controls Controls	Will not enhance the depuration process	Will not consistently achieve this level	Maximum of 14 years for sediments only	Minor impacts having no adverse impacts	No
3. Upgrade Runon Control with Capping	Will enhance depuration proces by 30 percent	Will not consistently achieve this level	Approximately 10 years for sediments only	Minor impacts having no adverse impacts	No
4. Upgrade Runon Control with Capping and Treatment	Will achieve 0.5 ppm	Will achieve this level	Approximately 10 years to achieve and maintain sediment and surface water levels	Minor impacts having no adverse impacts	No
5. Upgrade Runon Controls and Treatment of Discharge	Will achieve 0.5 ppm	Will achieve this level	Approximately 10 years to achieve and maintain sediment and surface water levels	Minor impacts having no adverse impacts	No
6. Treatment of discharge water	Will achieve 0.5 ppm	Will achieve this level	Approximately 10 years to achieve and maintain sediment and surface water levels	Minor impacts having no adverse impacts	No
7. Mechanical Removal of Sediment	Will achieve 0.5 ppm	Will not consistently achieve this level	Immediate achieval of 0.5 ppm sediment level	Major impacts with potentially adverse	No

N/A - Not Applicable

TABLE 4.2 ORDER OF MAGNITUDE COST ESTIMATES OF THOSE REMEDIAL ALTERNATIVES FORMULATED FOR THE SALTVILLE WASTE DISPOSAL SITE

	Costs Estimate[a]
Management of Migration	
A. Mechanical sediment removal	$669,089,000
B. No Action	624,000[b]
Source Control	
A. Upgrade runon control with ditches/berms	651,300
B. Upgrade runon control with ditches/berms, and treat pond outfall discharge with chemical precipitation.	7,993,200
C. Upgrade runon control with ditches/berms, and treat pond outfall discharge with chemical reduction.	10,960,000
D. Upgrade runon control with ditches/berms, and treat pond outfall discharge with activated carbon adsorption.	7,331,000
E. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and install ground water monitoring (gwm) system.	7,996,200
F. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with chemical precipitation and install gwm system.	15,338,200
G. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with chemical reduction and install gwm system.	18,304,900
H. Upgrade runon control with ditches/berms and cap with synthetic membrane liner and treat pond outfall discharge with activated carbon adsorption and install gwm system.	14,675,900
I. Treat pond outfall discharge with chemical reduction.	10,932,700
J. Treat pond outfall discharge with chemical precipitation.	7,966,000
K. Treat pond outfall discharge with activated carbon adsorption.	7,303,700
L. No Action.	624,000[b]

[a]Costs updated and discounted to July 1986. Values presented are capital costs and O&M costs (using a 6% discount rate).

[b]Values shown are similar since the continuation of current No Action activities impact both the source and the MPMR.

Implementability--

The implementability of a remedial alternative is its ease of installation or constructability and the time required to achieve a given level of response.

Constructability--The constructability of a remedial alternative is essentially the ability to construct or physically implement a practical remedial alternative. For Saltville, this involves the construction of a workable treatment system on a given site adjacent to Waste Pond 5.

Each of the three remaining treatment alternatives being evaluated (NaSH precipitation, Sulfex precipitation, and carbon filtration) have similar construction requirements. The site tentatively selected for construction of the treatment facility (refer back to Figure 8) must be grubbed and graded, For the first two technologies, a concrete foundation will be poured for a 100 ft x 100 ft area, 30 ft x 50 ft of which will be covered by a metal-clad and roofed building. The building will have small laboratory facilities, certain critical equipment (such as pumps and chemical storage, and mixing tanks which need weather protection), a storage and maintenance area, and an administration/work office for a two-man staff.

The concrete foundation area for the carbon treatment alternative is expected to cover only 30 ft x 50 ft, one-half of which will support a building of tbe type and functions described for the sulfur precipitation alternatives.

There are no known limitations to constructing any of the three treatment alternatives on the site. Equipment to construct the plant and unit operations for plant processes are readily available. Utilities (water and electricity) exist at the municipal wastewater plant 100 yards southwest of the site. That plant could receive sanitary discharge from the leachate treatment plant.

Time--The time to implement and the time to achieve beneficial results are two critical aspects of remedial planning.

> Time to Implement--Vendor estimates and construction experience at similar sites have been used to project the time of implementation for each of the three proposed alternatives. Pilot testing of each technology is anticipated to occur during the concentual design phase of work which follows this feasibility study. Jar testing will be needed for each sulfur precipitation treatment method, and a bench-scale carbon filter should be tested also. Testing results will confirm the effectiveness and cost performance of each technology. Testing will probably require a period of 6 to 8 weeks to complete.
>
> Time to implement any one of the alternatives is considered as the time to purchase equipment, install shakedown, and begin full operation of the treatment plant. It is expected that the minimum time required to accomplish these tasks will be as follows

(excluding time for obtaining necessary permits, which is assumed to be the same for each treatment alternative):

Technology	No. of weeks
Sodium sulfhydrate	24 - 40
"Sulfex" (iron sulfide)	24 - 40
Carbon filtration	18 - 24

Sulfide processes will require the most time because equipment must be purchased from a number of vendors. Additional time is spent in preparing bid packages and specifications for each vendor and in ensuring that pumps, tanks, piping, and chemical feed systems, for example, from different sources are well integrated. The "Sulfex" process may require less implementation time because much equipment is available from a single manufacturer who can also install the treatment system. However, it will be considered to have a implementation time equal to NaSH to be conservative.

The carbon filtration technology is available from a single vendor. Filters are kept "on the shelf" for immediate application and can be dispatched to sites very quickly. Installation is rapid and relatively easy. Construction of sitework, building, and surge and equalization tanks and installation of utilities will require the most time for implementation of this alternative.

° Time to Achieve Beneficial Results

Mercury concentration in Pond 5 discharge to the river will decrease from a peak of 120 ppb to below 20 ppb immediately upon full operation of any one of the three alternatives.

Safety --

Each technology was evaluated with regard to safety during construction and operation. In general, the guidelines of EPA, OSHA, NIOSH, and the U.S. Army Corps of Engineers will be followed during each stage of remedial construction at the site in order to prevent safety hazards to on-site workers.

Construction accident risks will be limited to hazards typical in the industry for work involving concrete sitework, building erection, mechanical equipment installation, and utility service connection. Because the construction site is above the waste pond leachate by more than 60 feet and no mercury vapor emissions have been detected during recent site visits, even on very hot days expected to release volatiles, no contact with hazardous substances is possibly by workers except for during construction of the surge tank in the leachate and plugging of the outfall pipe. Construction sitework will otherwise occur in noncontaminated areas.

No exposure to the surrounding community should occur for any process reagent or chemical reaction occurring at the site. Based on the above review, none of the three alternatives poses an unusual safety hazard. Carbon filtration involves the least exposure of workers to toxic or dangerous materials.

Upgrading runon control with concurrent treatment by either of the three systems will result in a decrease in both discharge flow and discharge mercury concentrations from the No Action levels. The mercury concentration from the Waste Pond 5 outfall will decrease to below 20 ppb. At this mercury concentration, the river surface water and sediment levels will approach and be maintained at 0.05 ppb and 0.5 ppm. The reduction in discharge flow and concentration will result in a decrease in the flux of mercury into the river from a No Action average value of 10 g/day to 1.6 g/day.

Disturbances to the area around the Waste Pond 5 discharge will occur as a result of the construction of a treatment facility. However the disturbance is considered to have a negligable impact on the aquatic and terrestrial ecosystems. Consequently, the treatment of Waste Pond 5 discharge concurrent with upgrading runon control will be effective in reducing mercury concentrations to levels considered protective of the environment.

Upgrading runon control with concurrent treatment of the discharge from Waste Pond 5 will eventually result in a decrease in both discharge flow and discharge mercury concentrations from the No Action levels. The flow rate from the Waste Pond 5 outfall will decrease from 0.05 to 0.04 cfs with the water being treated to bring mercury concentrations in the discharge to 17 ppb, as stated previously. At these discharge rates and mercury concentrations the river surface water and sediment levels will approach and be maintained at 0.05 ppb and 0.5 ppm in a minimum of 10 years. The advantage of the treatment alternative over an alternative with no treatment is that surface water concentrations of mercury will not exceed 0.05 ppb.

The potential exposures via direct contact and inhalation during and after construction of the treatment facility are expected to be similar to the previous alternative, with additional consideration for the construction and operation of the treatment facility. The construction of the treatment facility will be outside of Waste Pond 5, in an area of no known contamination. However, construction of the surge tank and the plugging of the outfall pipe will occur in contaminated areas suggesting that worker exposure to elevated levels of mercury in soils and leachate is possible. The body dose levels of mercury resulting from such exposure are impossible to estimate due to the limited amount of scientific information quantifying the dermal absorption of mercury. Construction of this remedial activity increases the chance of worker exposure over the No Action alternative mainly due to the construction of a surge pump and plugging of the outfall pipe.

The operation of the treatment facility introduces additional exposure to other hazardous materials (process chemicals for pH adjustment such as H_2SO_4, and NaOH) and the generation of potentially hazardous sludges. Laboratory accidents, such as chemical spills are considered to present a potential for exposure via direct contact with acids or inhalation of any gaseous fumes or vapors. Additional risks incurred as a result of the operation of the treatment

alternative include truck accidents resulting during the transportation of the sludge to an offsite RCRA facility.

The FS estimates that the cost of this alternative would range between the following:

Remedial alternative	Total capital cost ($)	Annual O&M costs ($)	Present worth of annual costs ($)	Total present worth ($)
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using sodium sulfhydrate precipitation	860,052	245,687	1,946,407	2,806,459
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using iron sulfide (sulfex) precipitation	2,143,052	219,687	1,750,407	3,894,459
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using carbon filtration.	840,052	182,687	1,469,407	2,309,459

This does not include costs for a groundwater monitoring system. These costs will developed when further studies on the hydrology are completed.

Alternative 4: Upgrade runon controls with ditches/berms/downchutes, cap pond 5 with synthetic membrane liner, install ground water monitoring system, and treat outfall using either sulfide precipitation techniques or carbon adsorption

Alternative 4 combines alternatives 2 and 3 and includes capping of Waste Pond 5. Alternative 2 and 3 have been described previously, hence this section will focus on capping. Capping is a very feasible remedial alternative component (but not a remedial alternative alone) for Waste Pond No. 5, because of its potential to prevent surface water infiltration into the sludge and consequently reduce the amount of contamination migrating to the NFHR. The approach to capping formulated in previous sections is expected to account for settlement and stability problems, and if implemented properly, is expected to be reasonably effective.

The cover design is in compliance with RCRA closure and post closure care requirements in that the cover is designed to:

- Provide long-term minimization of migration of liquids;
- Function with minimum maintenance;
- Promote drainage; and
- Accomodate settling and subsidence so that the cover's integrity is maintained.

A cross-section of the proposed cap design is illustrated in Figure 9. In general, this cap design employs the use of a 100 mil (0.1 inches) flexible membrane liner (FML) designed to cover the entire 70-75 acres of Waste Pond 5. Fill and geotextile materials are also employed to stabilize the sludge surface. The cover will be sloped in general conformance with the discontinuous or not consistent with the general slope, diversion pipes or channels will be placed over the cover to convey the water. If depressions in the cover exist, pumping may be required to remove this water. The cover may require reinforcement in those areas. The cap may be fitted with compensation joints that will accomodate settlement if it occurs. A compensation joint is an area where the liner material is folded. If tension is applied, the liner will compensate by unfolding.

Performance--

The capping of Waste Pond No. 5, together with upgraded surface water runon controls, will minimize surface water infiltration which are both major contributors to the cause of mercury contamination of the NFHR. A large percentage of the water that seeps through the sludge and mobilizes mercury comes from precipitation and surface water runon from upland areas. A properly functioning cover will prevent some of this water from coming into contact with the mercury sludge and therefore reduce the environmental and health hazard from the Pond. Peak mercury concentrations will be reduced. Mercury flux will be reduced as well.

Capping will be particularly effective for the Waste Pond because most of the mercury is located in the upper layers of the sludge (18 feet) above the water table. Consequently, a large percentage of the water that comes in contact with the mercury seeps down from the surface. Ground water base flow accounts for the remaining flow out of the outfall, however, a ground water study is necessary to determine the flow.

Site conditions that could potentially affect the performance of a cover are sludge instability and settlement characteristics. As indicated in Section 3 of the FS, there is great potential for the sludge to settle when subjected to heavy loads. The cap design introduced in this study has been tailored to accomodate these conditions. The cap is lightweight and may be fitted with compensation joints to accommodate any settlement that may occur. Layers of fill and geotextile are included in the design to add stability to the sludge surface and bearing capacity to support the machinery used in liner installations. Additional geotextile material can be applied to areas where additional support is needed.

When evaluating useful life, a number of factors must be considered. The primary concern of liners exposed to the sun is degradation from ultraviolet radiation. Schlegal has indicated that a liner manufactured with 2 percent carbon black is expected to be sufficiently resistant to ultraviolet degradation. In addition, the thicker the liner, the less impact ultraviolet degradation will have on liner integrity. Representatives of Schlegal lining

Company have indicated that thick liners (i.e., 100 mil) installed in arid climates with prolonged exposure to the sun, have lasted up to 50 years Schlegal indicated that humid environments are more favorable for liners. Thus, it is conceivable that a thicker gauged liner installed in climatic conditions characteristic of Virginia will remain structurally stable for at least a 50-year period. At the end of this period, complete liner replacement may be required.

Another consideration under useful life is the effect of continual stress on the liner. Three conceivable occurrences could cause continual stressing of the liner:

- Ponding of water;
- Differential settlement of the sludge; and
- Ground subsidence due to water table lowering.

As stated earlier, the liner system is capable of enduring these stresses for prolonged periods of time. However, it is conceivable that breaches could occur. The advantages of leaving the liner exposed are that failures can be quickly detected and the liner can be easily accessed for repairs. Thus, a breach could be detected and repaired before unfavorable events occur. Consequently, the useful life of the liner is prolonged due to the ease in monitoring and repair of the liner.

Reliability--

Flexible membrane liners have gained widespread use as barrier layers in the recent past. They have been installed in liner systems, under liquid impoundments and disposal units, in cover systems over waste disposal units, and other liquid and waste barrier applications. They have been demonstrated to be effective in preventing migration of liquids. A flawless FML is virtually impermeable. However, construction fabrication flaws are sometimes unavoidable and therefore it cannot be assumed that FMLs are leak free. Nevertheless, a well constructed FML can be an extremely effective barrier.

Exposed FMLs have been installed as covers over liquid impoundments, reservoirs, and anaerobic digesters and have performed extremely well Thick gauged FMLs (i.e., 80 to 150 mil) have endured hot, arid climates for periods of of up to 50 years.

Lining companies have installed thick FMLs as barrier layers over anaerobic digesters. In these applications the liner is designed to conform with the liquid level of the impoundment. The thicker gauges of FMLs have been used due to their strength capabilities in accommodating the stresses resulting from liquid level movement. These FMLs have been reported to perform extremely well with little or no difficulties in these applications.

Geotextiles and fill layers have been used in many applications to enhance stability and improve bearing capacity underneath highways, along slopes under

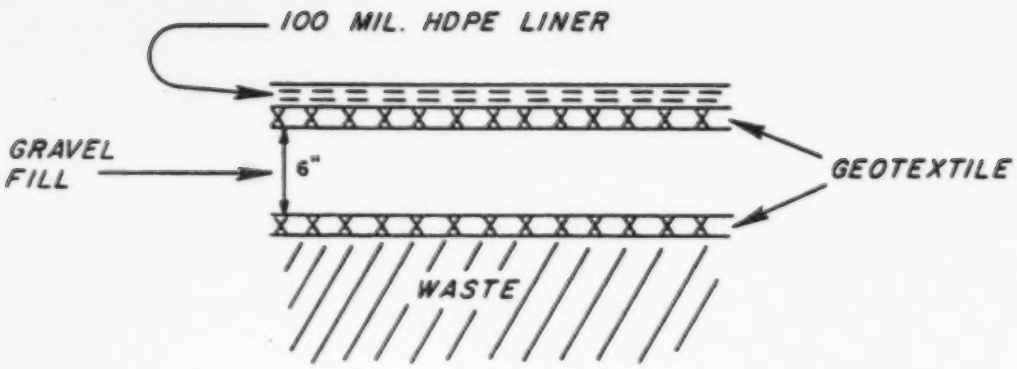

Figure 9 Cross-sectional view of proposed cap overlying Waste pond No. 5.

wastes disposal units, etc.. It is expected that the support layer design will be sufficient to support machinery used in liner applications. Where extremely soft sludge is encountered, additional layers of geotextile may be used to enhance stability.

Operation of the capping system may involve surface water pumping if depressions in the liner system are evident and prolonged ponding occurs. Continual monitoring of the site will be required to scan for tears or breaches in the liner. Maintenance may be required if breaches or tears occur or if the slope of the surface water conveyance system is disturbed. Maintenance will involve relatively simple liner patching activities and reassemblement of the pipe system.

Operation (i.e., pumping of surface water) of the site could occur rather frequently during winter and spring months if ponding of water occurs. However, the pumping activities would be rather simple because water would only be pumped to the perimeter run-on control system or one of the main surface water conveyance pipes installed over the liners. Monitoring of cap integrity should be rather frequent (i.e., monthly) so that failures can be detected and repaired expeditiously.

Implementability--

Construction of the cap will be complicated by the settlement and stability characteristics of the sludge. Extreme precautions will have to be taken to avoid disturbing the sludge. Stability problems were encountered during and after the construction of a portion of the runon control system over the sludge. However, by using careful techniques, the construction was somewhat successful. The contractor placed a geotextile over the surface of the sludge to attempt to stabilize the surface. Subsequently, layers of the runon control system were placed in thin lifts to avoid substantial disturbance. Precautions were taken to avoid inducing substantial machinery loads on the system.

Similar precautions should be taken during installation of the cover system. The layers of fill and geotexitles are expected to provide sufficient bearing capacity and stability enhancement for construction activities. Substantial machinery loads should be avoided over the softest portions of the site (i.e., the westerly and central portions). In these areas it may be more feasible to manually install the FML. Schlegal has indicated that the liner material can be manufactured in smaller, more manageable rolls. Additional layers of geotextiles may be placed if additional support is needed.

It is conceivable that construction will be prolonged due to difficulties encountered during construction. Installation of a liner over a stable foundation could be accomplished in approximately 1 month. However, the structual difficulties associated with Waste Pond No. 5 could prolong construction from 2 to 3 months. This accounts for time to install the fill and geotextile layers. In addition to construction difficulties, contigencies such as adverse weather conditions must be considered. Liner manufacturers recommend that liners not be installed in windy, wet, or cold weather(temperature below 40°F are unfavorable). It is probable that all or some of these conditions will persist throughout the year (particularly winter and spring). Thus, time must be set aside for these contigencies. Schlegal estimates that at least 2 to 3 weeks

be set aside to account for weather contigencies. Based on the above time estimates, it appears that installation of a cap over Waste Pond 5 could take take from 3 to 6 months.

Beneficial results may not be seen immediately after this technology is implemented. Results of concentration monitoring of the outfall after the construction of a runon control system suggests that there is at least a 6-month lag in time to see beneficial results. The lag exists because of the time it takes for water to infiltrate through the sludge. Thus, it is conceivable that beneficial results will not be seen until 6 months after construction.

Safety--

There are no major safety-related issues concerning threats to nearby communities and the environment. Threats to the environment are not expected to increase during implementation of this alternative. Worker potection in accordance with OSHA must be instituted during cap construction (particularly during installation of geotextile and fill layers). Extreme care will have to be taken when driving heavy construction machinery over the sludge to avoid stability failures and vehicle accidents.

Risk from exposure to mercury via direct contact with contaminated soils or leachate was considered possible for workers during the construction of the cap and treatment facility. Additionally, exposure via inhalation of contaminated dust or vapors generated by these construction activities was considered possible for area residents. Exposures via these two routes are considered to be temporary, lasting only for the duration of the construction period. Once the cap is in place exposure via direct contact or inhalation will be significantly reduced.

The treatment alternatives present additional risks from exposure to process chemicals and hazardous sludges. The risk to the operators of the treatment facility will continue for the duration of treatment operations. Truck accidents resulting from the transporation of hazardous sludges to an offsite RCRA facility is considered to present an insignificant risk.

The treatment of Waste Pond 5 discharge water in addition to upgrading runon controls and the placement of a full synthetic flexible membrane cap over Waste Pond 5 will result in a decrease in the mercury concentrations to approximately 69 ppb. The resultant flux of 0.118 g/day mercury into the river will result in approaching and achieving mercury concentrations of 0.05 ppb in surface water and 0.5 ppm in sediments. At those levels mercury levels in fish tissue will fall below 1 ppm. Disruption of the area around Waste Pond 5 will result during the construction of the treatment facility and placement of the cap however this disruption to the terrestrial and aquatic ecosystems is considered to be negligible. The treatment of Waste Pond 5 discharge concurrent with upgrading run-on control and the placement of a full synthetic flexible membrane cap will be effective in protecting the environment.

The FS estimates that the cost of this alternative would range between the following:

Remedial alternative	Total capital cost ($)	Annual O&M costs ($)	Present worth of annual costs ($)	Total oresent worth ($)
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install ground water monitoring system, treat outfall using sodium sulfhydrate precipitation	8,455,035	405,922	3,456,927	11,911,962
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install gwm system, treat outfall using iron sulfide (sulfex) precipitation	9,738,035	379,922	3,260,927	12,999,962
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install gwm system, treat outfall using carbon filtration	8,435,035	342,922	2,979,927	11,414,962

Recommended Alternative

Section 121 of SARA adds a new section to CERCLA that establishes a variety of requirements relating to the level of cleanup for remedial actions under CERCLA. This section codifies many of the existing requirements under the NCP, but also establishes additional directions for selecting permanent remedies and for meeting state requirements (ARARs - listed in Table 2).

The basic requirements for a selected remedy are that the remedial actions be:

1) Protective of human health and the environment;
2) Cost effective;
3) In accordance with the NCP; and
4) In accordance with new SARA provisions.

Considering the current and potential site hazards, the recommended alternative is alternative 3. Alternative 3 has been chosen as a interim alternative due to the studies still needed to define the extent of contamination. This alternative consists of upgrade runon control with ditches/berms/downchutes, treatment of Pond 5 outfall, and grounwater monitoring. In addition to this interim remedy, a groundwater study, bioassessment, and additional sampling along the NFHR need to be implemented. Once these studies are complete, a final remedial action could be developed. It should be noted that an interim alternative does not have to comply with all SARA requirements. However, this interim alternative does make use of treatment options.

The No Action alternative is not effective in mitigating the mercury exposed hazard to the environment at the Saltville Site. Under the No Action alternative, mercury concentrations in the sediment will remain above 0.5ppm and mercury surface water concentrations will exceed 0.05ppb at certain times of the year. These environmental conditions will result in mercury fish tissue levels greater than 1ppm, and will continue to adversely impact the integrity of the aquatic ecosystem (decrease in species diversity and vitality). The concentrations of 0.05ppb in surface water and 0.5ppm in sediments. Consequently, these alternatives contribute to the effective and timely cleanup of the aquatic environment at the Saltville Site.

Comparison of Alternatives and Consistency with other Environmental Laws

Alternative 1

The No Action Alternative is required by the NCP, 40 CFR 300.68, to be developed and considered as part of the CERCLA. The No Action Alternative developed for the Saltville Site consists of continued compliance to the Special Order (issued by the VSWCB to Olin Corporation on August 1982), continued monitoring and analysis of fish, and river sediments and water, maintenance of existing onsite runon control structures, and site security.

This alternative does not meet the goals of the NCP which are to minimize or mitigate threats to the human health and the environment and provide adequate protection of human health and the environment. Fish and fresh water in the NFHR will continue to receive mercury-contaminated wastes.

The No Action alternative is not in compliance with applicable Federal and State RCRA closure/post closure requirements (40 CFR 264 Subpart G) and does not address groundwater contamination (264 Subpart F). It is presently unknown to what extent groundwater is contaminated.

Alternative 2

This alternative appears to help minimize threats to the environment through a moderate reduction of the flow of contaminated effluent from Waste Pond 5 to the NFHR. This alternative does not, however, appear to provide adequate protection of the environment because the untreated, contaminated effluent will continue to enter the NFHR at only a slightly reduced volume. This alternative is not in compliance with applicable Federal and State RCRA closure and groundwater monitoring requirements at 40 CFR 264 Subparts G and F.

Runon controls should be upgraded in compliance to RCRA specifications. State standards appear to be equivalent to the Federal RCRA standards. Appropriate and relevant requirements include 40 CFR 264.301(c) for landfills and 264.221(d) for surface impoundments. Under 264.301(c), the runon control system must be designed, constructed, operated, and maintained to prevent flow onto the active portion of the landfill during a peak discharge from at least a 25-year storm. Under 264.221(d), surface impoundments are required to have dikes that are designed, constructed, and maintained with sufficient integrity to prevent massive failure of the dikes. The runon control system specified in this alternative is designed to withstand at least a 25-year storm and the associated dikes are designed to have sufficient structural integrity. Runoff controls and associated collection and holding facilities are not applicable nor relevant and appropriate requirements to this alternative at Waste Pond 5. The purpose of runon control is to reduce the amount of water reaching the Waste Pond and to reduce the amount of contamination run-off generated. The runoff resulting from diverting runon onto the Pond will remain uncontaminated and will flow naturally into the NFHR. Although the upgrading of runon controls does not appear to involve direct contact with the contaminated wastes, OSHA should be consulted for proper worker safety and health guidance prior to commencing any work at the site.

Aside from specified detection and compliance monitoring programs in Subpart F, corrective action requirements at 264.100 may also become applicable or relevant if groundwater contamination is evident. Under the RCRA regulations, corrective actions must attain a groundwater cleanup standard established for each facility. For a limited number of potential contaminants, a standard is specified in the regulations at levels corresponding to National Interim primary Drinking Water Standards (NIPDWS) developed pursuant to the Safe Drinking Water Act. 40 CFR 141.11 specifies maximum contaminant level for mercury of 0.002 mg/L. In the absence of an ACL or a standard based on Safe Drinking Water Act determinations, the groundwater protection standard of 0.002 mg/L mercury (264.94) is considered a background level. It should be noted that the State of Virginia has specified a more stringent MCL for mercury at 0.0002 mg/L to protect groundwater (Section 10.060.05 of the Virginia Hazardous Waste Management Regulations).

Alternative 3

The influent to the proposed treatment facility (i.e., the existing Pond 5 discharge) is a RCRA hazardous waste (40 CFR 261.3(c)(2)). In addition, wastewater sludge or spent carbon generated by the treatment process may be considered a characteristic RCRA hazardous waste, since its expected mercury concentration is sufficiently high to cause it to exceed the EP toxicity limit for mercury, 0.2 mg/L (40 CFR 261.24).

Construction and operation of the treatment facility must be in compliance with RCRA facility standards and administrative requirements for hazardous waste storage, treatment or disposal facilities under 40 CFR Part 264 Subparts A through H. The treatment facility will be designed and operated in accordance with these requirements. Performance aspects of the treatment facility will be regulated under the Clean Water Act's NPDES program governing wastewater discharges, as discussed below, and will not be regulated under RCRA (40 CFR 261.4(a)(2)).

Sludge or spent carbon generated during the treatment process will be temporarily stored on-site while awaiting off-site transport and disposal. Sludge or soent carbon will not be stored on-site for more than 90 days. Therefore, according to 40 CFR 262.34(a), the on-site storage of these hazardous wastes will not require a RCRA permit. However, they must be stored in compliance with the requirements of 40 CFR Part 265 Subpart I (interim status standards for storage of hazardous wastes in containers). These requirements are ordinarily administrative in nature and do not impose stringent design standards on sludge storage facilities. They will be complied with through proper recordkeeping and operation of the storage facility.

RCRA regulates the off-site transport of hazardous wastes through the adoption of certain DOT regulations governing the transport of these wastes. RCRA hazardous waste transport regulations are specified under 40 CFR Part 263 and encompass transporter identification numbers, manifests, recordkeeping and hazardous waste discharges during transport. The off-site transport of hazardous sludge or spent carbon from the Saltville site will be performed in DOT-approved transport containers by a commercial hauler having an EPA transporter identification number. In this manner, the off-site transport of wastes from the Saltville site will be performed in compliance with the Part 263 requirements.

In accordance with the NCP and specified under 40 CFR 300.68(a)(3), off-site disposal of hazardous wastes removed from CERCLA sites can only occur at facilities that are fully permitted under appropriate federal and state regulations (i.e., a fully permitted RCRA facility). The hazardous sludge or spent carbon transported off the Saltville site must be disposed of in such a facility. A fully-permitted RCRA disposal facility that will accept the mercury-contaminated sludge or spent carbon from the Saltville site has not been identified as part of this study. However, commercial RCRA landfills only access wastewater sludges for disposal, depending on the solids content and chemical make-up of the sludge. It is not expected that this sludge area is hazardous to health.

issue will significantly impact implementation of a treatment alternative, although the time required to implement the alternative may be lengthened if it is difficult to locate a permitted landfill that will accept the waste from the Saltville site.

Under Section 402 of the Clean Water Act, the Federal government has authority to regulate wastewater discharges through the NPDES permit program (40 CFR Part 415 Subpart F). The State of Virginia is authorized to administer the NPDES permit program at the State level.

It is assumed that the NPDES permit for the discharge will set a limit on the concentration of mercury in the discharge in order to achieve the water quality standard for mercury of 0.05 ppb in the NFHR. Allowable mercury concentrations in the treatment process effluent have been estimated by GCA based on the modeling of mercury loading to the river. Based on vendor information, the three treatment alternatives under consideration are capable of generating an effluent in which the concentration of mercury will be within the allowable limits. Therefore, it is expected that the Saltville treatment facility will comply with the mercury discharge requirements of its NPDES permit.

Federal requirements under Executive Orders 11988 and 11990 governing the impacts of activities on floodplains and wetlands are applicable to certain portions of the Saltville site. However, since the proposed treatment facility will not be constructed on those portions of the site designated as floodplains or wetlands, these requirements will not impact implementation of a treatment alternative.

Treatment system effluent will be discharged to the NFHR. Construction of the discharge outfall will not physically modify the NFHR. It is assured that water quality will also not be modified as long as NPDES discharge permit requirements are complied with. Therefore, requirements of the Fish and Wildlife Coordination Act, et al., will not impact the implementation of treatment alternative.

OSHA requirements for worker health and safety are applicable to construction and operation of the treatment facility on the site. During these activities, workers will come into contact with and handle hazardous substances such as the influent to the treatment facility and the sludge or spent carbon generated by the treatment process. Proper worker health and safety practices will be instituted during the facility's construction and operation to comply with OSHA requirements. Thus, OSHA requirements will not significantly impact implementation of a treatment alternative.

The Hazardous Waste Management Regulations administered by the State of Virginia (Chapter 6, Title 32.1, Code of Virginia) are essentially equivalent to Federal requirements under RCRA. Thus, the impacts of the Virginia Hazardous Waste Management Regulations on implementation of a treatment alternative are the same as those related to RCRA regulations, as previously discussed.

Under the CWA, the Federal government has authorized the State of Virginia to promulgate enforceable water quality standards. As a result, the Va. SWCB administers the Virginia State Water Control Law. Under this law, the State has set a water quality standard for total mercury in fresh water of 0.05 ppb. This standard will be enforceable for the NFHR in January 1987. As a result, the discharge of treatment process effluent to the NFHR must not cause total mercury concentrations in the river to exceed the 0.05 ppb limit.

Construction of the treatment facility on the Saltville site must be approved by the Saltville Town Council and variances to local zoning ordinances may be required for the facility. No other local requirements have been identified as pertinent to a treatment alternative at the site. Town Council approval for the facility and any needed variances are not expected to interfere with implementation of a treatment alternative.

Alternative 4

This alternative appears to minimize threats to the environment through a large reduction in the flow of contaminated effluent to the NFHR. Less water will be allowed to run onto the Pond and mix with the mercury-contaminated sludge, therefore reducing the amount of contaminated runoff generated. The institutional issues and considerations for the second remedial alternative also applies to the runon controls specified in this alternative.

Capping will further minimize the amount of runon, and hence minimize the amount of contaminated run-off to the NFHR. The installation of a cap appears to effectively minimize the flow of contaminated effluent from the Pond to the NFHR which will result in a reduced impact to the environment. As stated in the previous analyses of alternatives, human health is not currently an issue at the Saltville site. Because this alternative proposes to close the Pond with waste left on-site, both landfill and surface impoundment closure requirements become applicable. The proposed cap is equivalent, as technically feasible, to applicable RCRA landfill and surface impoundment cap design requirements (40 CFR 254.228(a)(2)(ii) and .310) and EPA guidance. State standards for final covers are equivalent to Federal RCRA standards. The proposed cap will provide long-term minimization of migration of liquids through the closed landfill/impoundment, function with minimum maintenance, promote drainage and minimize erosion or abrasion of the covers, and will accommodate settling and subsidence so that the cap's integrity is maintained. Prior to capping, all free liquids must be eliminated by removing liquid wastes or solidifying the remaining waste and waste residues, and remaining wastes must be stabilized to a bearing capacity sufficient to support a final cover (264.228(a)(2)(ii)). Due to the nature of the wastes in Pond 5 a true RCRA cap design as specified in EPA guidance document on "Landfill Design Liner Systems and Final Cover", July 1982, was not technically feasible. The proposed cap contains several layers with a flexible membrane as the final cover. Due to the instability of the wastes, no soil or vegetation was proposed. Runon will be directed by lateral branches on top of the flexible membrane and pumped out of the Pond area and into the NFHR. The runon and runoff control systems and proposed

maintenance appear to be in compliance with applicable RCRA landfill and surface impoundment requirements specified at 40 CFR 264.228(b) and .301(d)(e), and 264.310(b).

This alternative proposes to implement RCRA closure and post-closure requirements in compliance with applicable RCRA regulations at 40 CFR 264 Subpart G. State closure standards appear to be equivalent to the Federal RCRA closure standards. Section 264.111 of Subpart G specifies that the facility must be closed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to prevent threats to human health and the environment, post-closure escape of hazardous waste, constituents or leachate to the ground or surface waters or the atmospheres. All facility equipment and structures must be properly disposed of or decontaminated following closure (264.114). An independent registered professional engineer must certify that the facility has been properly closed (264.115).

Section 264.117 specifies a post-closure care period for 30 years during which applicable monitoring and reporting requirements must be complied with and post-closure use of the property must never be allowed to disturb the integrity of the final cover. Sections 264.119 and .120 require the local land authority to be notified upon closure and a specified notice to be inserted in the deed to the property. The implementation of a RCRA closure/post-closure program is also expected to minimize and mitigate threats to and protect future human health and welfare and the environment.

RCRA closure requirements also specify that groundwater must be monitored pursuant to 40 CFR 264 Subpart F (Section 264.117). The proposed closure specifies a groundwater monitoring program in compliance with Subpart F. RCRA groundwater protection requirements establish a three-stage program to detect, evaluate and, if necessary, correct groundwater contamination. Initially, the uppermost aquifer and its characteristics must be identified. The EPA Regional Administrator must then specify hazardous constituents to be monitored for (264.93) and maximum concentration limits for those constituents (264.94), as well as identify the point of compliance at which the ground water monitoring standard applies and the monitoring must conducted (264.95). The location and construction of the well monitoring system must be in compliance with 264.97. The detection and compliance monitoring programs must be carried out pursuant to 264.98 and .99.

The combined effect of upgrading runon controls and implementing wastewater treatment of the effluent from Waste Pond 5 is expected to have greater impact on minimizing and mitigating threats to and protection of the environment than Alternative 1 or 2. The volume and concentration of contaminants flowing to the NFHR is expected to further decrease with the implementation of this alternative.

Before this alternative could be implemented, a groundwater study, bio-assessment and additional sampling need to be completed. Furthermore, a consensus on the significance of seepage under the Pond 5 dike as a service of mercury loading is unknown. Alternate 4 was not chosen due to the absence of information to justify and implement this alternative. Alternative 3 was chosen as an interim alternative.

Costs

The projected costs were developed in accordance with EPA policy for estimating costs within a reasonable range of the actual implementation costs. Table 6 lists costs of the remedial alternatives proposed.

TABLE 6 - COSTS OF REMEDIAL ALTERNATIVES PROPOSED FOR THE SALTVILLE SITE

Remedial alternative	Total capital cost ($)	Annual O&M costs ($)	Present worth of annual costs ($)	Total present worth ($)
No action	N/A	39,254	370,044	370,044
Upgrade runon control with ditches/berms/downchutes	50,052	42,687	402,407	452,459
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using sodium sulfhydrate precipitation	860,052	245,687	1,946,407	2,806,459
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using iron sulfide (sulfex) precipitation	2,143,052	219,687	1,750,407	3,894,459
Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using carbon filtration.	840,052	182,687	1,469,407	2,309,459
Treat Pond 5 outfall using sodium sulfhydrate precipitation	810,000	242,254	1,914,044	2,724,044
Treat Pond 5 outfall using sulfide (sulfex) precipitation	2,093,000	216,254	1,718,044	3,812,044
Treat Pond 5 outfall using carbon filtration	790,000	179,254	1,437,044	2,227,044
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install ground water monitoring system	7,645,035	163,668	1,542,883	9,187,918

TABLE 6. (continued)

Remedial alternative	Total capital cost ($)	Annual O&M costs ($)	Present worth of annual costs ($)	Total present worth -- ($)
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install ground water monitoring system, treat outfall using sodium sulfhydrate precipitation	8,455,035	405,922	3,456,927	11,911,962
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install gwm system, treat outfall using iron sulfide (sulfex) precipitation	9,738,035	379,922	3,260,927	12,999,962
Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install gwm system, treat outfall using carbon filtration	8,435,035	342,922	2,979,927	11,414,962

Table 7 presents a sensitivity analysis of total present worth cost of the remedial alternatives and variations of the alternatives. Alternative 3 could range between $2,300,000 to $3,900,000 depending upon treatment technology chosen.

There are no costs presently developed for the groundwater study, bioassessment or additional sampling and monitoring. EPA will be undertaking these studies in the near future.

TABLE 7. SENSITIVITY ANALYSIS OF TOTAL PRESENT WORTH COST OF REMEDIAL ALTERNATIVES

Variation	No action	Upgrade runon control with ditches/berms/downchutes	Upgrade runon control with ditches/berms/downchutes and treat Pond 5 outfall using sodium sulfhydrate precipitation	Upgrade runon control with ditches/berms/downchutes and treat Pond 5 with iron sulfide precipitation	Upgrade runon control with ditches/berms/downchutes and treat Pond 5 with carbon adsorption	Treat Pond 5 outfall using sodium sulfhydrate precipitation	Treat Pond 5 using iron sulfide precipitation	Treat Pond 5 using carbon adsorption	Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, install ground water monitoring system	Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, treat outfall using sodium sulfhydrate precipitation	Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, treat outfall using iron sulfide (sulfex) precipitation	Upgrade runon control with ditches/berms/downchutes, cap Pond 5 with synthetic membrane liner, treat outfall using carbon adsorption
Standard Analysis[a]	$370,044	$452,459	$2,806,459	$3,896,459	$2,309,459	$2,726,044	$3,812,044	$2,227,044	$9,187,918	$11,911,962	$12,999,962	$11,414,962
Amount of Liner Needed:												
1. 25% increase	NA	NA	NA	NA	NA	NA	NA	NA	10,296,955	13,020,999	14,108,999	12,523,999
2. 25% decrease	NA	NA	NA	NA	NA	NA	NA	NA	8,122,836	10,866,878	11,934,878	10,349,878
Liner Installation Cost:												
1. 50% increase	NA	NA	NA	NA	NA	NA	NA	NA	11,405,993	14,130,037	15,218,037	13,633,037
2. 50% decrease	NA	NA	NA	NA	NA	NA	NA	NA	6,969,842	9,693,886	10,781,886	9,196,886
Installed Cost of Treatment Systems:												
1. 50% increase												
a. Sodium Precipitation	NA	NA	3,402,360	NA	NA	3,319,945	NA	NA	NA	12,507,863	NA	NA
b. Iron Precipitation	NA	NA	NA	5,141,429	NA	NA	5,059,014	NA	NA	NA	14,246,932	NA
c. Carbon Adsorption	NA	NA	NA	NA	2,748,662	NA	NA	2,667,247	NA	NA	NA	11,854,185
2. 50% decrease												
a. Sodium Precipitation	NA	NA	2,241,248	NA	NA	2,158,833	NA	NA	NA	11,346,751	NA	NA
b. Iron Precipitation	NA	NA	NA	2,626,382	NA	NA	2,543,967	NA	NA	NA	11,731,685	NA
c. Carbon Adsorption	NA	NA	NA	NA	1,868,233	NA	NA	1,758,818	NA	NA	NA	10,971,736

[a]Cost data presented obtained from Table

NA = Not Applicable.

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RESPONSIVENESS SUMMARY

This community relations responsiveness summary is divided into the following sections:

Section I Overview. A discussion of EPA's preferred remedial alternative and the public's expected response to this alternative.

Section II Background of Community Involvement and Concerns. A discussion of the history of community interest and concerns raised during remedial planning activities at the Saltville Waste Disposal site.

Section III Summary of Major Comments Received During the Public Comment Period and Agency Responses. A summary of comments and responses categorized by topic.

I. OVERVIEW

The selected alternative outlined in the ROD consists primarily of upgradient stormwater control by construction of ditches, berms, and swales and detoxification of contaminated material in an onsite pond. This is essentially the same alternative which was proposed in September, 1986 but not finalized. It is an interim solution, which will be followed by additional study and cleanup measures. Community interest throughout this project has been low and continues low. Most comments on the FS were received from the States of Virginia and Tenessee (which is several miles downstream of Saltville, Va.) and Olin Corp.

Little public response is anticipated upon signature of this ROD. However, the parties previously mentioned undoubtedly will provide input at decision points throughout the project.

II. BACKGROUND OF COMMUNITY INVOLVEMENT AND CONCERNS

The height of community interest was reached with the closing of the Olin plant in 1971. Although contamination from the Olin facility resulted in a ban on fishing in the North Fork of the Holston river many years ago, residents and former employees remained disinterested. The only negative comment received by EPA Region III was the only written comment received during the comment period. The resident suggested "the removal of contamination to Mr. Olin's home."

In 1978, a task force comprised of several state and federal agencies was formed to guide remedial actions at the site. The task force has been involved in most remedial plans and actions undertaken since that time.

The comment period on the focused Feasibility Study began May 21 and ended June 11. The comment period and the availability of the Feasibility Study were announced in a press release sent to all Saltville area media, and in a quarter-page ad in the Saltville News Messenger (attached to this summary) which appeared May 21. This ad offered a public meeting if needed. None was requested during the comment period.

III. Summary of major comments received during the comment period and agency responses.

Risk Assessment

Comment: The Risk Assessment should have been revised to incorporate data gathered through 1986.

Response: The risk assessment was completed without the 1986 data because of the imminent expiration of EPA's contract with NUS Corp., the contractor which prepared the document. Past data provided enough information to complete this portion of the project, and additional studies are planned which would make use of all available data.

Comment: The Risk Assessment did not include actual consumption survey data and failed to consider ingestion of contaminated floodplain soils as a potential pathway. Available literature suggests using from 1.0 g/day to 5.0 g/day as a reasonable ingestion rate for Allowable Daily Intake calculations.

Response: Additional studies are recommended which may address these issues.

Comment: The predictive model which associates sediment concentrations with fisheries contamination cannot be considered acceptable until the continuous and variable loading of uncontaminated non-point source sediment is accomodated. In addition, a reasonable program to field verify sediment/fish relationships at specific sample sites should be defined including the use of available sediment/fish data.

Response: An updated report of the RA/FS will be issued based on the new data generated in the studies as well as current data from members of the task force.

Feasibility Study

Comment: Remedial action should address possible mercury seepage under Pond 5.

Response: The ground water study described in this ROD will attempt to address that issue.

Comment: The Feasibility Study should have reconciled the discrepancy between EPA's assertion that 92 percent of total mercury is methyl in form as opposed to Olin's conclusion that 50 percent of total mercury is in methyl form.

Response: This discrepancy will be resolved at the conclusion of a full bioassessment.

Comment: EPA has not demonstrated that there is a potential groundwater problem at the site. Therefore, a geohydrological study is unnecessary. EPA has not demonstrated any environmental effect on flora and fauna of the North Fork Holston River area, therefore a study of whole body concentrations is unnecessary.

Response: The Feasibility Study states that there is not enough information to determine if ground water contamination is present. There is no ground water data available. Therefore, a study will be done to determine whether ground water is a potential route of exposure.

Comment: The water quality standard occasionally is exceeded within the mixing zone of the outfall from pond five. It is not "consistently exceeded" in the river as noted in the FS.

Response: The fact that water quality standards are exceeded in the river is EPA's primary concern. The consistency of this problem will be better documented in future studies.

Comment: A party disagrees that the No Action alternative in the FS would not sufficiently protect the environment. The No Action alternative includes maintenance of the already implemented remedial measures, which are effective in reducing mercury discharge to the river.

Response: EPA believes that mercury concentrations have not been reduced by remedial measures. This phenomenon appears to have been caused by seasonal changes.

Comment: A party had several comments on implementation of EPA's preferred alternative.

- Runon control plans are impractical, considering the composition of soil and waste material in the path of diversion ditches.

- Plans to use the waste pond as an equalization basin will impound liquid behind the dikes and lower their stability.

- EPA's cost projections for implementation of the preferred alternative probably are much too low. They do not take into account the difficulty of working on an unstable surface (waste disposal areas.)

- EPA's proposal to utilize a wastewater treatment plant during the cleanup may be impractical.

Response: These issues will be thoroughly explored and addressed in the design phase of the interim measure.

Other Comments

Comment: Mile 52 of the Holston River should be identified as the downstream boundary of investigations related to the Saltville site.

Response: This recommendation will be followed in future studies.

Comment: EPA projects the life of a synthetic membrane proposed under the capping alternative as approximately 50 years. Such membranes have been in use only 30 years. Olin Corp. projects the effective life of such a membrane as less than 5 years. As such, they are not cost effective in this instance.

Response: At this time, there is insufficient information to evaluate the validity of this comment.